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MODEL AIRPLANE NEWS

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Redhawks!

.40 Engine Shoot-Out

Radio Installation

Care & Operation of the Glow Engine

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MODEL AIRPLANE NEWS

ON THE COVER AND ABOVE: Flying in formation for Budd Davisson's camera are the fabulous Redhawks, one show-stopping aerobatic team that performs gravity-defying stunts. Read about this daring trio on page 16. Photo by Budd Davisson.

FEATURES

CONSTRUCTION

COLUMNS

COLUMNS

DEPARTMENTS

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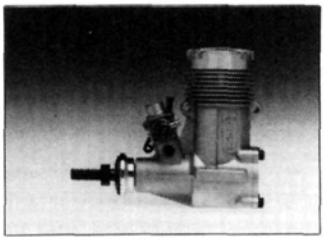
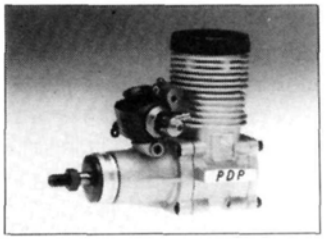
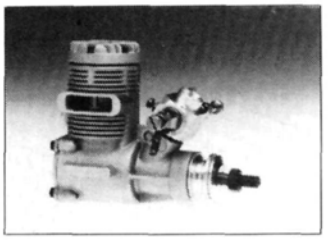
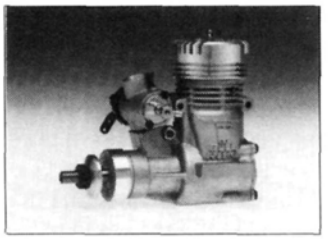
Editorial

by LOUIS V. DeFRANCESCO, JR.

YOU'RE GOING to love this issue! Because of the incredible popularity of our first engine shoot-out (April '86), we thought we'd follow up the act with the ever popular sport powerplant, the .40 engine. Since its first introduction in the early '60s by one of modeling's true pioneers, Duke Fox, the .40 engine has been the backbone engine of the modeling community for almost three decades. The results are printed herein; and most were store-bought so the manufacturer couldn't slip in a hand-selected one. You decide what engine is for you.

Mr Chinn, our resident engine expert, has arduously researched the history and development of this ubiquitous engine and has left nothing to conjecture, as usual. Once you've finished his treatise you'll be an expert for sure.

When most newcomers to the hobby hear the name Charles Hampson Grant, I'm sure it evokes little response. But this early editor of *Model Airplane News* was also a famous aeronautical engineer when names like Wrong Way Corrigan, Emilia Erhart and Charles Lindberg were household words. I urge you to read the story about this great man as his designs have influenced commercial aviation as we know it today.

And hey, guys, don't forget about our design contest on page 127. It's a great way to get some notoriety and cash for one of your scratch designs.

We've packed a lot into this issue—it's our commitment to provide you with the most informative and entertaining R/C airplane modeling magazine in the world. Let us know if we're achieving our commitments and goals.

Enjoy. ■

Airwaves

Leaning Toward Insanity!

Dan, I read your column regarding trouble-shooting two-stroke engines with interest. Perhaps you can help me with a problem that I've been unable to solve....

I have an O.S. .45 ABC engine installed in a Sig Kougar. The problem goes like this. First, I tune the engine on the ground for proper operation, not too lean. Then I check for maximum rpm and hold the plane vertical with the throttle wide open. So far, everything's great! Then I take off and, well, everything's suddenly not so great: I can't run the engine above half throttle and moving from half to full throttle doesn't increase the engine rpm. The engine leans out and/or stalls. Now, here's what I've tried to solve this problem. I tried changing fuel tanks—1 Kraft, 2 Sullivan—each one having a different liquid capacity and with a new fuel line. But no luck. I changed from a tuned pipe to a standard O.S. muffler—same operation. I disassembled and cleaned the engine, to no avail. A new radio—same thing. New prop—same thing. What baffles me is that the engine runs fine on the ground yet seems to lean out once airborne. Setting the plane back on the ground doesn't help either. If on occasion I do achieve full throttle in the air, it doesn't last long. Lately, the engine is killing glowplugs after a flight or two. I also tried running it with and without muffler pressure. I looked at the engine with a 5X magnifying glass and found no cracks. Last year the plane did the same thing with an O.S. .45 ringed engine. If *suction* is the problem then the engine wouldn't run at full throttle with the plane in a vertical position on the ground. If the engine is run on the ground and the tank pressurized by blowing on the vent tube, the engine stalls. This engine is driving me crazy!

CONRAD E. DUNNEBIER
Glastonbury, CT

The real clue to your problem seems to lie in the transition between ground-running and flight conditions. If it goes lean in the air and not on the ground, several things could be happening. For one, you may have a venting problem that doesn't allow sufficient air to the tank and in effect creates a vacuum inside the tank, thereby starving the engine. If, however, you're using muffler pressure with the vent plugged, I don't see how it could happen, unless you're getting foam in the tank. If you're using a nylon engine mount, that could be the culprit. Nylon mounts let the engine vibrate more than aluminum mounts, especially if your prop is not balanced. This lets the fuel foam-up. The fact that you're blowing plugs indicates that the engine indeed is running lean. Too many of these and you'll need a new engine! Try using the new Perry Regulated Pump; it will give a constant fuel pressure regardless of the location of the tank.

DBS

Weighty Matters

Does anyone remember Dan saying in the December '86 issue, "It is not the size that does the damage, it's the kinetic energy behind it"? Well, the night before the most recent issue of *Model Airplane News* arrived, my friend was sleeping with his pet, full-grown elephant and during the night the elephant rolled over and when my friend woke up he was dead and lying there flattened out like a piece of cardboard in human shape. I screamed to him a couple of times that Dan says it's not the SIZE that does the damage, it's the kinetic energy, but he hasn't moved and I guess he can't hear me. Look, let's face it, I'm chicken. You won't find me watching speed U-Control nor will you find me around a Formula I Pylon Racing event, it's just too hazardous, and these ½-scale Cubs and 747s frighten me to death. Pretty? Yes. Dangerous?—absolutely! A 12- to 15-pound model plane should be enough for anyone.

EARL POYNTER
Fort Worth, TX

Give your friend our deepest condolences.... *Staff*

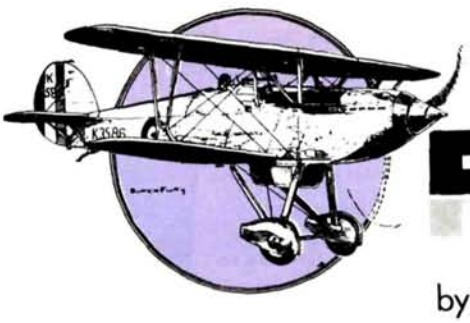
Congratulations on such a fine magazine. I was reading Dick Phillips' column and the AMA ruling on weight limits. I'm a newcomer to R/C, but as an ardent investigator and reconstructionist I'm very familiar with the mechanics of collision.

The damage resulting from a collision is a product of the kinetic energy of the striking object and the individual physical characteristics it has in the striking area. The kinetic energy is a product of weight and speed. Let me give a couple of examples, and please keep in mind that as a "glider-guider" I'm not very conversant with typical sizes and flying speeds of powered models.

A 25-pound ship flying at 80 mph generates about 5.350 foot-pounds of kinetic energy and distributes it over a relatively small striking area. Albert Doerr's Cub at 100 pounds flying at 40 mph generates the same kinetic energy but distributes it over a much larger area, which would cause less *predicted* damage in a collision. I don't fly giant scale so I take no sides here; however, my advice to the AMA is to consult an expert, or two, in the field of physics. I don't think, however, that large-scale models necessarily pose a greater risk or liability.

RICK McDOLE
Rialto, CA

We welcome your comments, opinions, and suggestions. Letters should be addressed to "Airwaves," Model Airplane News, 632 Danbury Rd., Wilton, CT 06897. Letters may be edited for clarity and length.



Fifty Years Ago...

by DAN SANTICH

THERE HAVE BEEN CHANGES in the hobby of modeling over the years that have resulted in major shifts of interest, activity, and enthusiasm. Adhesives advanced. What do you think modelers used for glue in 1937? It sure wasn't easy then. Glue was not only hard to find but it had an average cure time of sometimes days. Covering was done with either Japanese tissue or silk, the application of which was a tricky process at best and one that took great skill in obtaining a decent covering job.

Nitrate dope was popular in general aviation use and found a home as well in modelers' workshops. It worked both as an adhesive and as the source for many a glimmering beauty at the flying field. Miniature gas engines certainly added new dimensions to the hobby, as did the invention of the bellcrank for U-control flying and the glowplug.

It was the miniature gas-ignition engine that really changed things, and the Brown Junior engine that proved the turning point. It not only opened the door for new horizons but served as a durable and powerful means of propelling the dreams of thousands of modelers for many years. It was the springboard that launched careers in aviation, industry, and new business ventures. The hobby wouldn't be as we know it today if not for Bill Brown having acted on his dreams.

Modeling was getting attention all over the world. Motion pictures were using model airplanes for special effects, Hollywood actors were endorsing new products, and the general public was getting interested in this new trend.

General aviation was also seeing greater activity. Howard Hughes, an aviation innovator, was setting records for speed; Aeronca introduced a light plane with no wires to support the wing and dual wheel controls instead of the usual "joy stick"; Bellanca was developing a new airplane for the upcoming New York-to-Paris race, as was Lockheed, who had high hopes in their Model 14 with a top speed of 265 mph using twin 840-hp Wright Cyclone engines. Four-motored transports were seen as the way to more profits in commercial aviation and Douglas had their successor to the DC-3 well into the development stage. This airplane, the DC-4, was still a mystery, but was reportedly so large it wouldn't fit into most hangars due to its large vertical tail. New construction methods were helping aircraft manufacturers, as was the availability of new materials. Structures of metal were found to be superior both in weight and strength over traditional aircraft construction methods and the aluminum industry was to prosper because of the aviation demand.

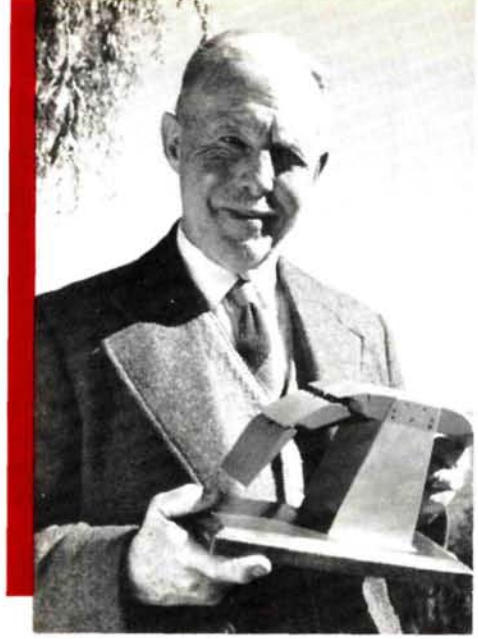
As Herman Wouk would describe in his book *Winds of War,* there were grave messages that things weren't right in the world. But in America in May 1937 it was still looked on as someone else's problem.

One of the best known manufacturers in 1937 was Reginald Denny who was not only a modeling force but a well-known Hollywood actor.

The engine that started it all, the Brown Jr. was a consistent, reliable performer in 1937.

Douglas DF21 passenger flying boat was flown in 1937. Twin 1,100-hp engines.

Modeling experienced great growth, both in new products and participation in 1937. The economy was recovering from the depression and aviation was a popular topic of discussion. People were finding new jobs, new ambitions, and new challenges. Modeling was one of these, and *Model Airplane News* was there to tell you about it, fifty years ago this month. ■



by FRANK GUDAITIS

1895-1987

CHARLES HAMPSON GRANT

ONE OF *MODEL AIRPLANE NEWS*' EARLY EDITORS WAS ALSO A TRUE PIONEER OF FLIGHT.

CHARLES HAMPSON GRANT was nine years old when the Wright brothers first flew at Kitty Hawk. It was an event which would have a profound influence on the rest of his life. Little did he dream then that one day fifteen years into the future, he would be working with one of these same Wright brothers, designing an advanced high-performance racing airplane.

His life was to become one almost totally dedicated to improving the art and science of flight. In retrospect, it is particularly poignant to realize that his many valuable contributions never received either adequate recognition, or monetary compensation from the aviation industry.

One cannot help but wonder if he had known as a youngster that his chosen profession would be so unrewarding; would he not have directed his energies into more remunerative channels?

As a fifteen year old in 1910, his thoughts must certainly have been keenly optimistic. His boundless enthusiasm resulted in the construction of a crude hang glider. It was a single wing affair which was attached to the handle bars and seat of his bicycle.

The first "flight" was attempted on August 15 of that year. It took place on a hillside near his home in Peru, Vermont. History records that he did actually manage to rise into the air for a short distance. Lacking any controls, he promptly stalled and crash landed. Fortunately, he was unhurt.

He then designed and constructed another glider with somewhat more conventional features. It was a 90-pound biplane with a wingspan of 25 feet. During the next few years, he made many successful flights down the slopes of Vermont's hillside terrain. In the process, he continued improving both his flying machine and his skills as an aviator.

In the understandable euphoria which resulted from all these glider flights, the die was cast for what was to follow for the rest of his 92 years.

He entered Princeton at 19 for a more formal engineering education. While there, he designed an advanced airplane which he named the Grant Fast Fighter. One of its unique features was a retractable landing gear, probably the first of its kind.

With the entry of this nation into the first world war, young Grant was accepted by the engineering branch of the U.S. Signal Corps, Aviation Section. He was then sent to the School of Military Aeronautics at the Massachusetts Institute of Technology, graduating in July of 1918 as a 2nd Lieutenant. With this commission, he was ordered to McCook field near Dayton, Ohio. There the Grant Fast Fighter design was offered to the Aircraft Production Board.

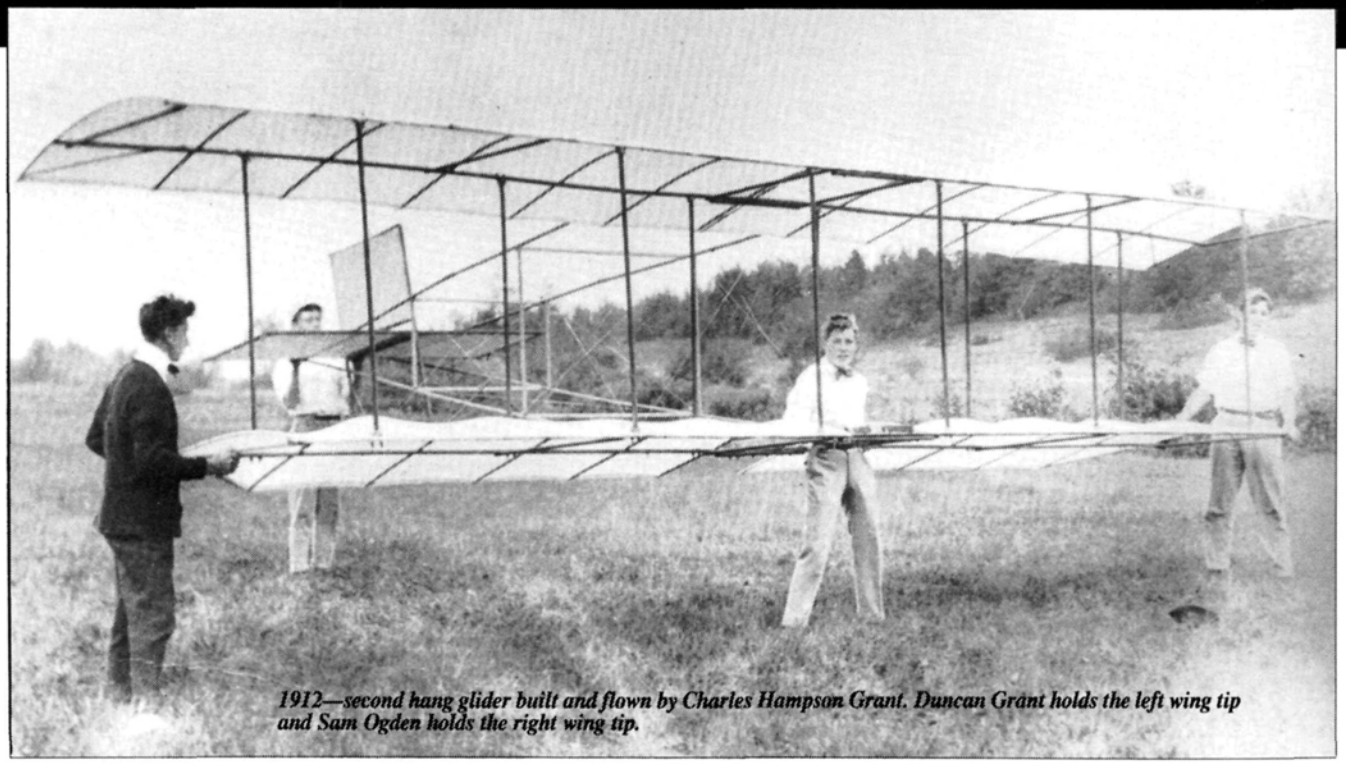
Unfortunately, by this time, the war was winding down and no new designs were being accepted for production. However, the French Air Mission also reviewed his design and found it sufficiently meritorious to award him a "Brevet D'Aviateur Militaire" citation.

With the return of peacetime, the aviation industry literally went from "boom to bust." Charles Grant then turned his attention to what was to become the model airplane manufacturing industry in America. In 1919, he designed and flew a successful pusher type miniature aircraft. This event took place at Dayton, Ohio, and was considered sufficiently noteworthy to have it recorded by a newsreel company. Historically, we can safely assume that this industry was born there and then.

Following this, in the same year, the chief pilot for the Dayton-Wright Company, Howard Max Rinehart, asked Grant to join their four-man design team. The others were Orville Wright and chief engineer Milton Bauman. The airplane which they were to design and build was a radically streamlined high-wing monoplane with retractable landing gear. It

Charles Grant holding his Pioneer flying model as his assistant winds the rubber motor.

From 1919 newsreel frame in Dayton, Ohio, Grant launches an ROG flight of his flying model.



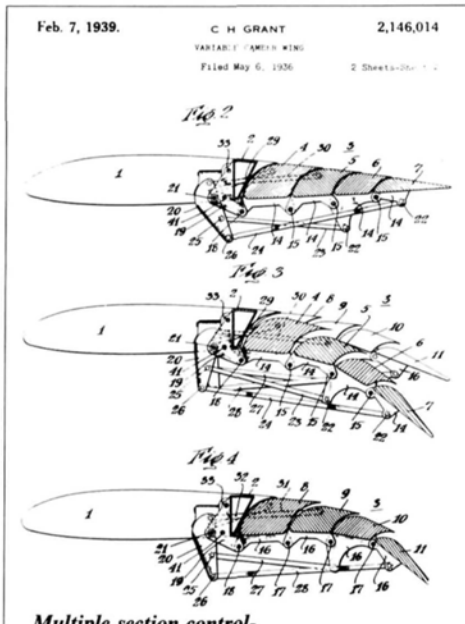
1912—second hang glider built and flown by Charles Hampson Grant. Duncan Grant holds the left wing tip and Sam Ogden holds the right wing tip.

was intended to race in France for the Gordon Bennett International Aviation Cup contest in 1920.

Rinehart was an old friend who knew about Grant's innovative engineering capabilities. Grant was asked to design a new kind of cantilever wing with movable leading and trailing edges. This was indeed radical thinking in an era of wire-braced fixed wings.

Grant delivered such a wing design and it performed as desired. However, lacking sufficient vertical fin area, the aircraft encountered severe directional stability problems—to the point of almost being uncontrollable at high speed. Needless to say, it did not win the race, and it can be seen today in the Ford Museum at Dearborn, Michigan.

Forty some odd years later, Charles Grant's same movable leading and trailing edge wing design was incorporated into the Lockheed F-104 supersonic fighter!


Feb. 7, 1939. C H GRANT 2,146,014

VARIABLE CAMBER WING

Filed May 6, 1936

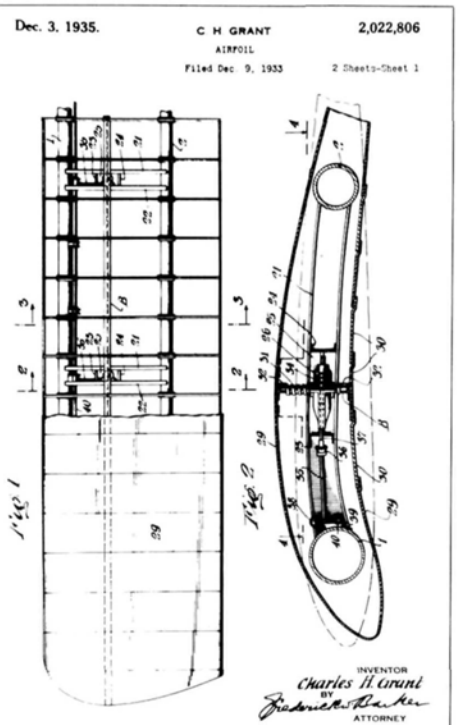
Fig. 2

Fig. 3

Fig. 4

INVENTOR
Charles H. Grant
BY
ATTORNEY

Multiple section controllable wing flap patented by Grant was an important invention found on all transports of today.


Dec. 3. 1935. C H GRANT 2,022,806

AIRFOIL

Filed Dec. 9, 1933 2 Sheets-Sheet 1

Fig. 1

Fig. 2

INVENTOR
Charles H. Grant
BY
ATTORNEY

In 1921, Grant and his wife Lillian returned to their home in Vermont where they founded Camp Duncan Grant. It was named after his brother who died in a mid-air collision while flying a Sopwith Camel in England during WW 1.

The camp was advertised as a unique "boy's camp of model airplane building and designing." It was operated by the Grants for the following 12 years. Fifty years later, Grant still received letters from men who were students at his camp, and some of whom went on to become leaders in the model airplane field. One of these men was Howard G. McEntee who became a major name in the radio control of miniature aircraft.

After Charles Lindberg's historic flight, interest in aviation became widespread. Grant then designed a completely assembled, ready-to-fly model airplane. It was the first of its kind and was manufactured and sold in such quantities that well over $300,000 worth reached the young hands of enthusiastic fliers during the next two years.

Unfortunately, the stock market crash of 1929 and the depression which followed wiped out all sales of these miniature flying airplanes.

In December of 1931, Charles Grant became the editor of *Model Airplane News*. It then had a circulation of twenty-one thousand. Within six months, this

(Continued on page 117)

EVERYBODY has a friend or two who is crazy. Of course, "crazy" is both a relative and a subjective term...what do you judge it against and who is doing the judging?

I have these three friends about whom I've heard a few, quite a few, aviators say, "Those guys are crazy!" They look up and see my friends, collectively known as the Redhawks, motoring around at 250 mph with only a foot or so separating their airplanes and they make a snap judgement, "They're crazy." Having spent many hours both in and out of cockpits with the three of them, I'd have to say

AEROBATICS WITH THE BOYS IN THE BAND.

Redhawks

by BUDD DAVISSON

The "boys in the band" (left to right): Carl Pascarelle, Harry Shepard, and Bob Gandt.

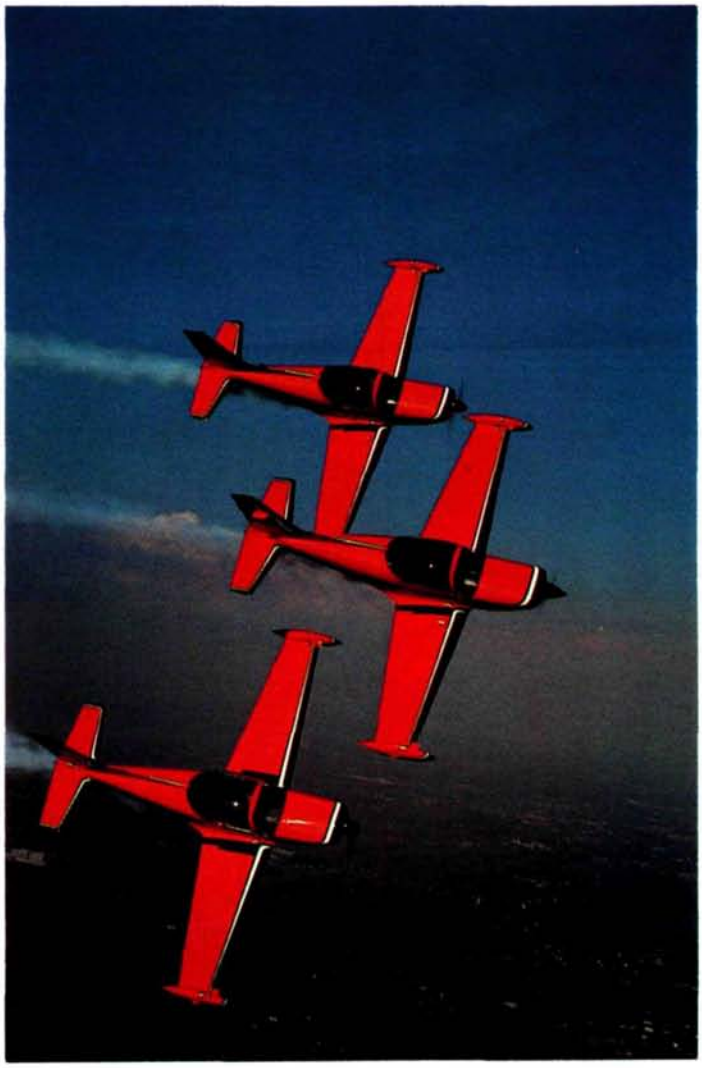
there is an element of truth to the judgement. But only a small element.

The first time I flew with Harry Shepard, the Redhawks' leader, we were in a WACO Meteor (aka Siai-Marchetti S.F.260, see following story) and were locked on to the right wing of yet another S.F.260. And we were doing loops and rolls. The other airplane was being flown by Larry Kingry and that was nearly 15 years ago. At that time there were only three Meteors (260s) in the country and these two guys were burning up the airshow circuit with their act. They are no doubt best remembered for being the only surviving act to do actual "mirror" flight loops and rolls...Kingry would be upside down with Shepard right-side up, his prop only feet from Kingry's head and their vertical fins overlapping. Kingry moved to the West Coast which broke up the act, thereby guaranteeing their "survivor" status.

Shepard, an airline pilot by trade and a fighter pilot by choice and training (U.S. Navy, F8 Crusaders, etc.), kept active in the airshow circuit doing a solo in his own Marchetti and during the late 1970s and early '80s is remembered for

aerobating a Temco TT-1 Super Pinto jet. He has probably logged more time going straight up than anyone outside the Blue Angels since the Pinto loves doing vertical rolls out of sight.

But Harry is a professional at judging what is right and what isn't. He's your basic detail freak and everything around him from his control-line models (yes, a few of us old fogies still fly "real" model airplanes) to his Mercedes is detailed to the nines. And he likes his flying to be detailed. However, in flying an airplane, even doing aerobatics at low level, the ability to judge details is more difficult than it sounds. When doing a maneuver it's hard to tell exactly how tightly you held the groove because there aren't any white stripes up there to judge your performance by. You can be 2 or 3 feet one way or the other and neither you nor your audience can tell the difference.



Then try that with another airplane right next to you. All of a sudden 3 feet looks like a mile and your eyes tell you your airplane is moving all over the sky even though your butt doesn't feel anything. Formation flying is the absolute ultimate in judging a pilot's ability to put an airplane where it is supposed to be.

For that reason Shepard had no choice. For his own mental health he had to put together another formation team. He was continually forced to answer the question "Is there life after being a Navy fighter pilot" with an emphatic "yes" and that meant keeping his skills honed so sharp their edges reflect no light. And that meant formation aerobatics.

But you don't bash around the sky with just anybody on your wing. Formation aerobatics is one of those things that separates the men from the supermen and strains your faith in your fellow man. Every pilot worth his salt wants to believe he is capable of the mission and every ex-military type is convinced he *is* capable of the mission. But damned few are. So, Shepard had his work cut out for him in finding wingmen.

Until you've tried it, you'll never know how difficult really close formation work can be. In the first place, it is an extremely complex interplay of visual, physical, and intellectual observations and movements. The name of the game is anticipating movement, spotting the tiniest amount, and then instantly analyzing the correct action. And everything counts! For instance, if you are low on your leader, it's not a simple matter of pulling to bring yourself into formation. If you just pull, the energy you burn to bring yourself up means you'll also fall back, so some power is needed. If you are in a turn of any kind, the difference in turn radius between yourself and your leader is incredibly influential in determining where you are going to wind up. If you are on the inside of the turn, you have more power and speed available than the lead because your radius is smaller. But on the outside just the opposite is true and you'll find the throttle buried in the instrument panel and you are tucking in as tight as possible to reduce the radius and the distance you have to travel.

Then think about this interplay of energy, power, and gravity while doing a three-plane barrel roll or loop. You get real busy, real fast.

Like I said, you don't go aviating with just anybody on your wing.

Shepard let the word out and instantly found himself up to his armpits in guys who thought they could cut the mustard. Most, after several flights, quickly found reasons why they couldn't devote the time to the project (family, kids, washing the dog, *Gilligan's Island* reruns, etc.). One, however, Bob Gandt, another ex-Navy fighter jock, fit the bill in every way possible. Besides having good hands, he had a good head and interfaced with Shepard very naturally, a feat in itself when you consider Shepard's tendency to push for perfection until everybody around him drops.

Gandt shared Shepard's long-time fascination with things that fly. In fact, all of the Redhawks were teenage pilots, went Navy, then airline, and still have a need for wowing crowds on weekends. Gandt is noticeably more laid back than Shepard (everybody is more laid back than Harry—everybody!) and is prone to a quiet understated type of humor, often gigging Harry.

The third 'Hawk is Carl Pascarelle. Carl came to the

team via a phone call I placed to Harry one night. "Harry, if you're still looking for pilots you can stop looking. I just flew with this guy who..." I had returned from Florida the night before where I had flown and shot the Christen Eagle seen on the April 1986 cover of *M.A.N.* That is Carl Pascarelle peeking over the cockpit combing while keeping the Eagle tucked under the Citabria's wing in a 60° bank. Guys like me who spend an unnatural amount of time looking at other airplanes through Nikon viewfinders have probably watched other guys fly formation more than even the Blue Angels or Thunderbirds. I've watched a thousand guys fly wing on me, but Carl was obviously one of the very, very best. This was the wingman for Harry.

Shepard flew with him one time and asked him on-board.

If Bob Gandt is laid back, then Carl is nearly horizontal. Nothing phases the guy! He's always smiling, always ready to fly, and always struggling to keep a bubble of aeronautical excitement within him from bursting forth. Even though he appears to be constantly cooling out, he still exudes an excitement about aviation that I've seen only a few times. He loves it all. He knows most of it. And he's willing to work until he can't move his hands any longer to be the best. Which he already is. Which they all are.

Flying with the Redhawks is the most exhilarating, most terrifying fun a pilot will ever experience. I wish every pilot could saddle up with them and see what really close formation is all about. I've done it any number of times and I still come back with a sweaty spot in the palm of my hands.

In the first place, when we are talking "close" formation, we are talking *close* formation. Since they only have 260 hp, they can't afford to be lollygagging around with the wingmen a half a wingspan away. In fact, in their signature "V" formation, the wingmen formate on Shepard, the leader, by putting his tip tank directly in front of the pilot, which means they are about 18 inches off center. Then they step down just enough to give their propellers about a foot of clearance under the tip tank. At no time are they farther than 18 inches apart and on the top of a roll, the outside man will slide in until maybe 8 to 10 inches separates his prop from Shepard's airplane since he needs that tiny bit of energy the radius change generates to hold position. It's at this point you understand their proximity is dictated by the laws of physics, not an overwhelming desire to scare the hell out of themselves.

When seen from the passenger's side, the effect is absolutely hypnotic. Shepard's tip tank is painted in your windscreen, moving ever so slowly in a circular ballet as Carl, my pilot, varies the position to give him the energy advantage he needs. Pulling up into the roll, you are only vaguely aware of the horizon slipping into odd angles, because you can't take your eyes off the tip tank for an instant. In fact, Shepard's airplane seems so static beside you, there is practically no feeling of motion. Only the G-force going in and the lightness at the top of the maneuver differentiate a barrel roll from sitting parked on the ramp. That's how static Shepard's airplane appears!

But your mind knows you are doing in excess of 230 mph and even the tiniest touch of the propeller would result in something you'd rather not think about. So you don't think. You concentrate on that tip tank in the windscreen and calculate how many minutes are left in their act until they land.

Crazy? Like I said, that's a judgement call and it's relative. It's relative to what you consider normal and the Redhawks consider what they do as being normal within the realm of what it is they're trying to accomplish.

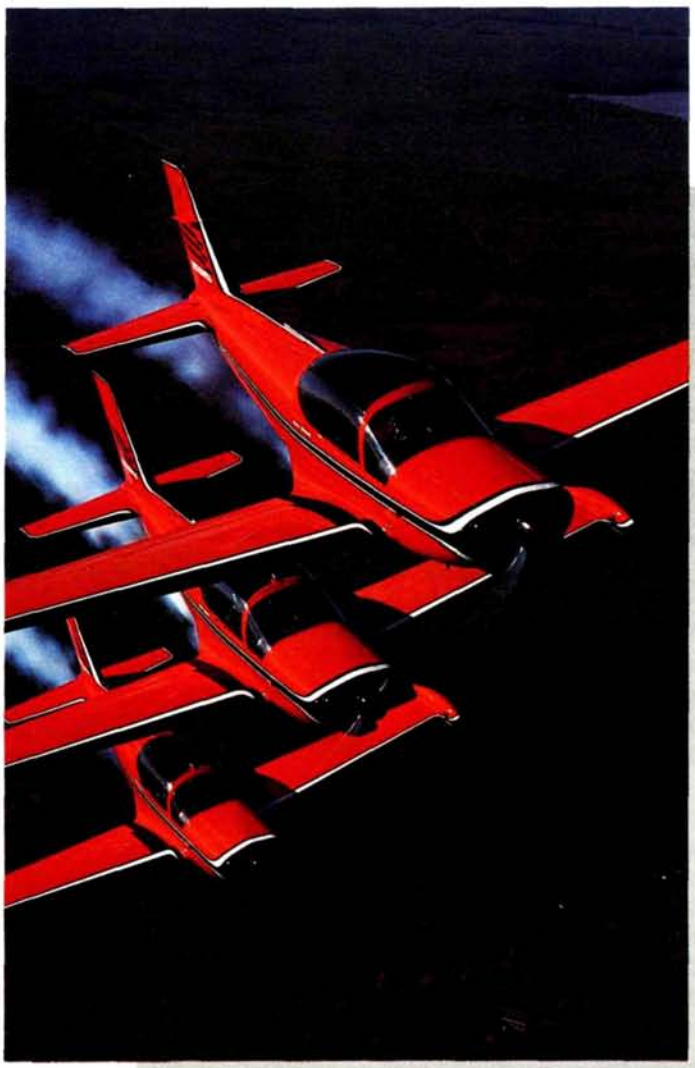
They want to be the best. And, if they aren't, they are closing fast on whoever is number one. ■

We're talking* close *formation. At no time are they farther than 18 inches apart.

Siai-Marchetti S.F.260

article and photo by BUDD DAVISSON

AIRPLANES are like women (no, I'll skip the stuff about airplanes only killing you once). Everybody has different tastes and everybody sees beauty differently. But, just like you'll never hear Jennifer O'Neal or Jane Seymour described as being just "Okay," you never find a pilot who doesn't love the Siai-Marchetti S.F.260. And those who have flown the airplane climb out of the cockpit with a white-hot love affair with the machine already in progress.



Stelio Frati, designer of the S.F.260, is one of the very few designers of general aviation aircraft whose name is instantly recognized by hard-core airplane buffs. Frati began designing airplanes back in the '50s and by the early 1960s had established himself as a designer of unbelievably sexy looking (most of them anyway) flying machines. The two which carried the Italian feel for sensual machines to the absolute limit were the Falco and the S.F.260. Both of them were low-wing, finely balanced machines which gave tremendous performance for the power. The Falco was a two-place tourer of all-wooden construction and the S.F.260 was an all-metal design with military applications.

As a civilian airplane the S.F.260 made very little initial impact on the market, but the military couldn't ignore it. Here was an airplane that had the feel of a small jet, but used a 260-horse O-540 Lycoming for power and was easy to maintain compared to their usual trainers. So many smaller air forces bought the airplane to use in their training cycle.

Not blind to a good thing, the 260 soon found the factory had fitted it with hard points for rocket rails and machine-gun pods. In fact, many of the airplanes found their way to Zaire and were frequently seen screaming across the tree tops with guns blazing and rockets flashing.

The airplane exists today in three basic models, the A, the B, and the C. The original A differs from the other two in having a fairly thin wing and a shorter vertical tail. The A also differs in that it has some of the worse slow-speed characteristics of any airplane ever offered to the civilian marketplace. When the wing unloads, it will drop a tip tank into the ground with no problem and the ailerons will have long since been ineffective. The B and C models changed the outer wing profile to eliminate the tip-stall tendency and worked in a number of mods, including aileron servo tabs, taller sticks, etc. Where the A could be a lunch eater in certain situations, the B and C are both well-behaved, high-performing tigers.

Although a design over 20 years old, the S.F.260 is still the fastest, normally aspirated, single-engine production airplane in the world. It will hit 234 mph flat-out and you can cruise all day long in the 210 to 215 mph range.

In the late 1960s, the airplane was being imported under the name WACO Meteor. Unfortunately, only three airplanes made the trip. These three were joined by a few that enthusiasts had located overseas and shipped in. Then, a few years ago, a Texas firm, Fox Five One, began working with the factory to import new and rebuilt airplanes. Consequently, there are close to two dozen of the machines cruising around America, giving their pilot's the time of their lives.

To a pilot who truly loves to fly, rather than just drive in the third dimension, the S.F.260 is his airplane. What the short wheel base Berlinetta Ferraris are to cars, that's what the 260 is to airplanes. It is built for pure, blazing performance and is as close to a

(Continued on page 105)

Small Steps

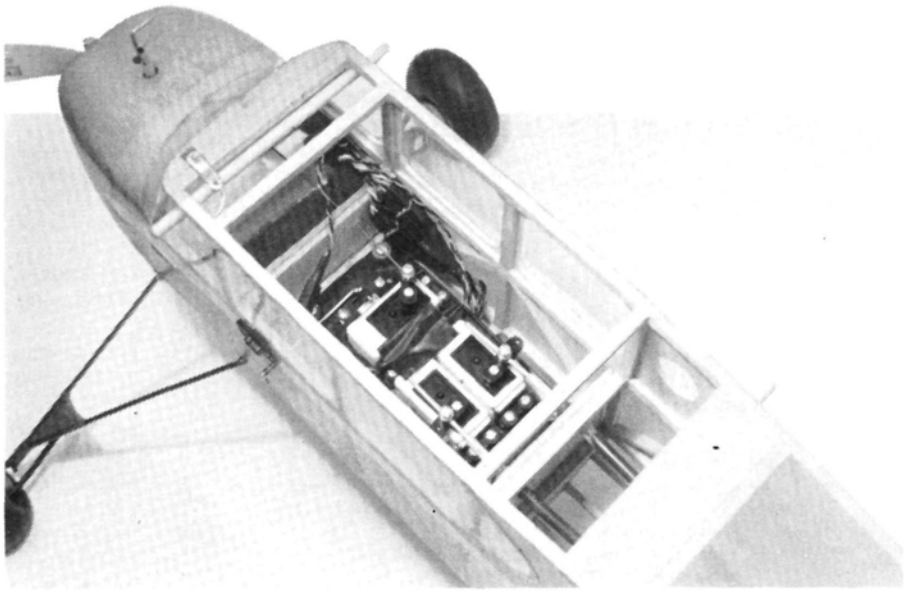
by JOE WAGNER

THIS COLUMN is still new enough that I haven't received any feedback from its readers yet. However, I've been talking about the subject of small R/C airplanes with numerous modelers in western Pennsylvania and eastern Ohio. What I've learned is that there is an all-too-common misconception about these little airplanes. Because they are small and simple, they're often thought of as being merely beginners' models and unworthy of serious attention by experienced R/C fliers.

This simply isn't so. I've been in modeling myself since 1935, flew my first R/C aircraft in 1947—and small, simple R/C models are my preference for what I build and fly today.

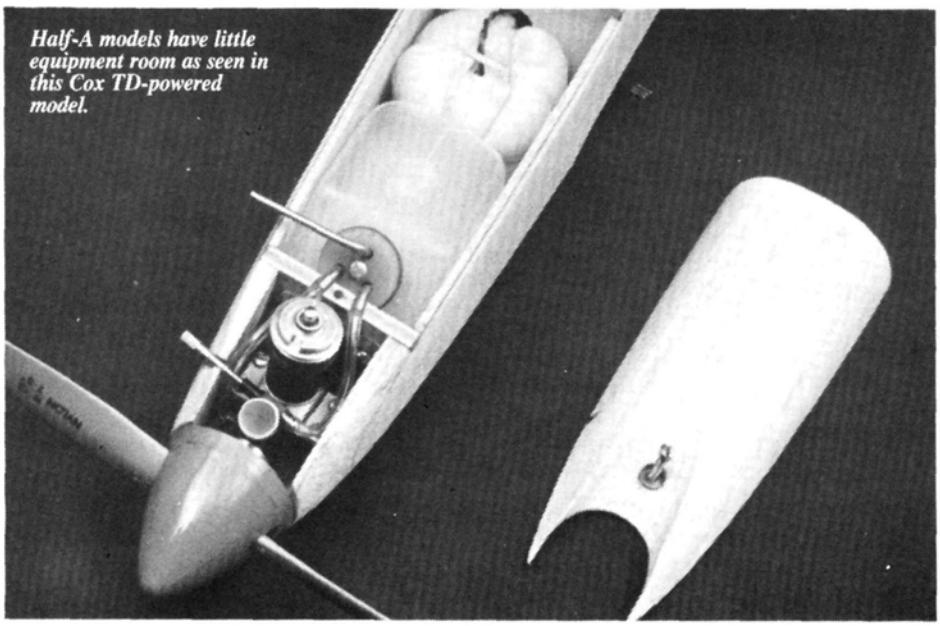
Why? First, they're challenging. Working with small models is much different than with the giant-size jobs. You have to *think*. Equipment installation has to be planned, and is usually done in steps as the model is built, to avoid having to use ship-model-in-a-bottle techniques to stuff the R/C gear into a fully-assembled airplane.

Second, small models are individualistic. Since they don't take nearly as much time and effort to build as say a quarter-scale project, this lesser investment of time (and materials) seems to make it easy to be adventurous. You can try your own ideas—aerodynamic, structural, and decorative—instead of being shackled to build-it-strictly-by-the-book procedures. Last winter a friend of mine spent months constructing an exact scale quarter-size biplane. (It lasted about six flights.) In the same time I built four small R/C models, plus some free flight and U-Control jobs. Not everything I tried worked perfectly; but I had models to fly all season long. And I had lots of fun doing it, too.

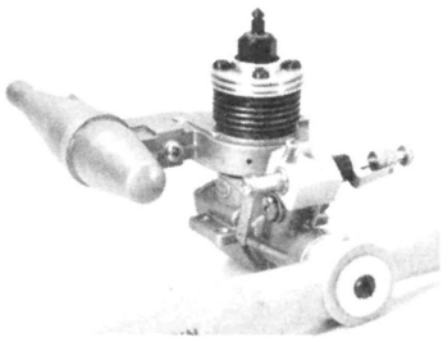


Old Timer designs usually have lots of R/C gear room. This 1938 Cleveland Cloudster is .049 powered with three-channel control.

Third, there are plenty of places to fly small, low-powered R/C models. I personally favor the tiny-engined type, with .020 or .049 motors. With these there's no need to drive miles out of town to a special R/C model flying field, have my transmitter impounded, wait for a fre-



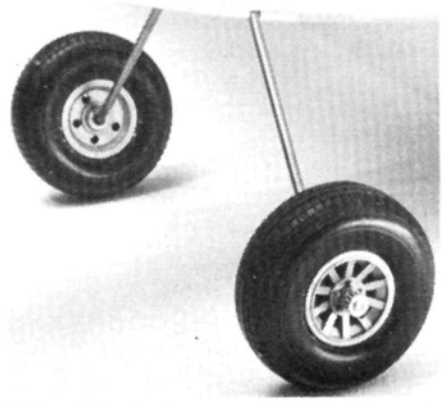
Half-A models have little equipment room as seen in this Cox TD-powered model.



G-Mark .061 is a fine powerplant for small R/C models. Throttle response is excellent.

quency pin, or any other formalities. I fly from schoolyards, athletic fields, and pastures—some within easy walking distance of my home—and do it informally, relaxedly, and very enjoyably. (I do the same with my larger models sometimes: the ones with .15 and .19 engines. But my fun favorites are the ½A ships.)

And fourth, you don't need a lot of field equipment to fly small R/C. I use a tiny field box, just big enough to hold a transmitter, a pint of glow fuel, a Ni-Cd starting battery, plus a few tools, spare props, and a roll of paper towels. Ready to



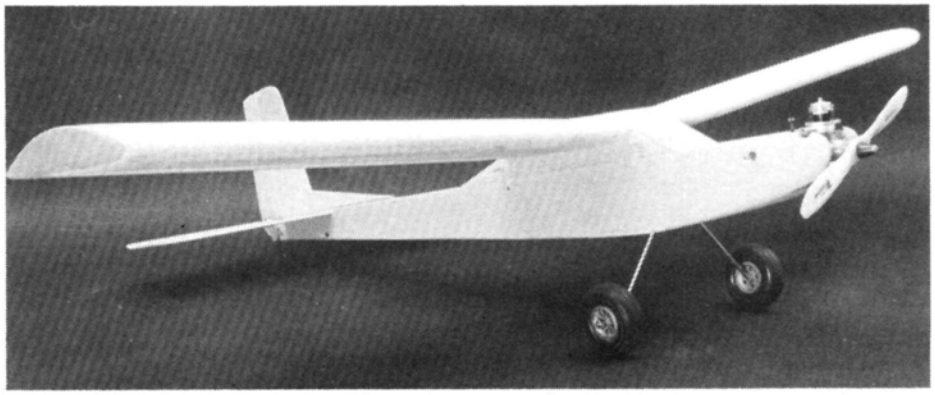
Lightweight wheels, a must for small R/C. Ace's new wheels: only 1.3 ounces for a 2¼-inch pair.

go it weighs less than 7 pounds.

Another misconception about small R/C models is that they don't really fly well; that they just "flit" through the air. This belief may have come from seeing overweight, over-powered miniatures in flight. But it isn't true of *good* small R/C models.

Still, it's a fact that there's a big difference between the way most small R/C models fly best and the way larger R/C airplanes are flown. Small ships perform most reliably when flown on their wings. "Pattern-type" models and similar high-powered ships are flown largely on engine thrust. With some planes the wings appear to be only additional control surfaces!

The types of small R/C models that I fly perform much like full-size airplanes.

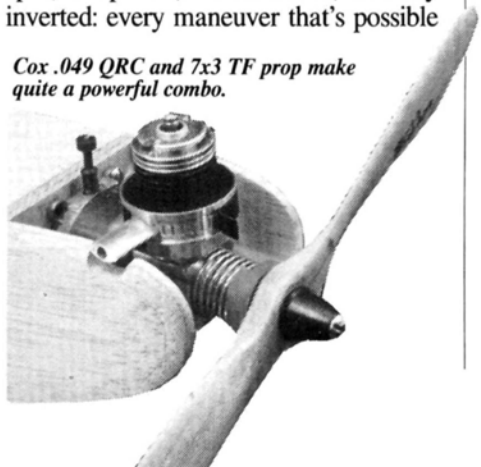


Ace R/C's Whizard .049 sport R/C model makes a great schoolyard flyer. This one simply needs finishing before it does what it does best—fly!

Their wing lift is what keeps them airborne, and their powerplants provide the thrust to maintain their airspeed. With a power increase, they climb. When the throttle is cut, they descend. The airspeed remains fairly constant throughout. This doesn't mean they aren't aerobatic, though. It only means that they need to be flown through their maneuvers rather than be dragged through them by excessive horsepower.

Most R/C modelers I know can't believe how big an R/C model can be flown with a tiny motor. Take Herb Clukey's big Megowcoupe, kitted by Flyline. Almost 4 feet in span, with 350 square inches of wing area, this size model usually gets a .15 or a .20 put in its nose. But the Megowcoupe flies just fine with an .049. Built according to the plans, with no beefing up or heavy finishes, it weighs less than a pound ready to fly—and it flies very well indeed. It will loop, spin, snap roll, Immelmann, and fly inverted: every maneuver that's possible without ailerons.

Cox .049 QRC and 7x3 TF prop make quite a powerful combo.



In my previous column I promised a review of three small R/C models kitted by Ace R/C*. These are the foam-winged trio of ½A airplanes designed by Owen Kampen: the powered-glider Ace High Mk.II, the highwing cabin model Whizard, and the low-wing aerobatic Pacer. All are intended for 2-channel R/C. The Pacer uses ailerons and elevators; the other two are controlled with rudder and elevators only.

All three kits have been around for ten years or more, and were originally designed to use R/C equipment that's no longer on the market. Today's smaller R/C systems fit quite easily into these models—but not today's larger fuel tanks! I had to use considerable ingenuity to fit the tanks into the Whizard and Pacer, even with new, wider fuselage bulkheads. I had some other problems with the kits too, and wrote to Ace about them. Tom Runge replied that these kits are up for revision soon, having been on the market for quite a while and with some of the tooling getting worn. Possibly by the time you read this the new kits will be available with the corrections I suggested.

(By the way, most model kit manufacturers are eager to hear from their customers—with either criticisms or compliments. I was in the kit-making business myself for years; first at Veco, then at

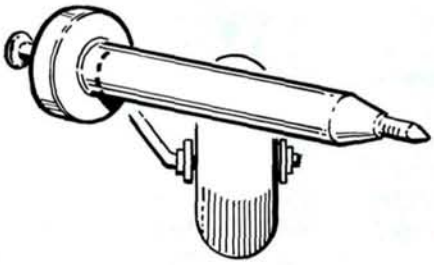
(Continued on page 104)

Hints & Kinks

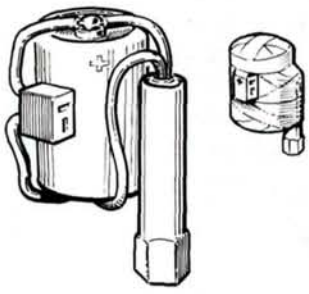
by JIM NEWMAN

Model Airplane News will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Hints & Kinks." Send rough sketch to Jim Newman, c/o **Model Airplane News,** 632 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO, AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we cannot acknowledge each one, nor can we return unused material.

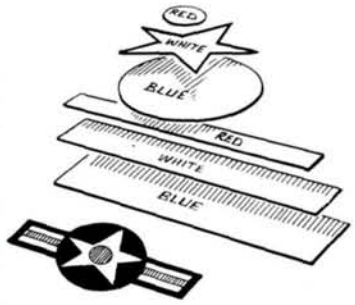
Ni-Cds can be as slippery as eels when you're trying to make them into a nice four-pack. Place them around a suitable balsa (or foam) block—a dab of tub seal helps, too—then tape securely. The block also helps tighten the pack and keep it square. *Richard Ohmann, Laurel, Maryland*



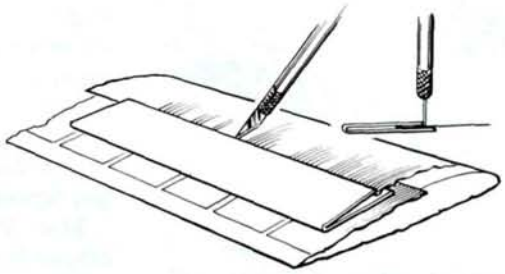
Ever seen those nylon pop rivets used to fasten ply to aluminum channel, especially in semi trailers? Pull out the steel mandrel, cut where shown dotted, and they become fine wheel retainers for small, light models. These are also good as pushrod exit bushings and antenna grommets, too.
Eugene King, Buffalo, New York



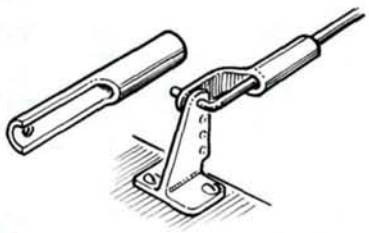
Take a 4,000-mAh Ni-Cd, tape it securely to a glowplug connector, and you have a useful, inexpensive Ni-Cd starter. Notice the socket soldered in parallel for connection to your charger. Take great care to observe correct polarity when wiring the charger socket.
Gar Williams, Naperville, Illinois



If you regularly place our national markings on your models, it is worth making up a set of manila card (or thicker) templates which you can lay on that useful Mono-Kote Trim Sheet. Cut out all the circles, stars, and bars, then apply in the order shown in the illustration. Purists! Yes! This is a composite marking! Omit the red center or bars as appropriate. Lay them on a surface swabbed with detergent and water mix, then slide them around. Squee-gee out the excess, then blot. *Bill Kawai, Mie-Ken, Japan*



Some people have trouble getting those nice straight color divisions when using iron-on films. Make this simple device from a manila folder (see the end view). Iron nearly up to the edge of the overlapping color, then lift the remaining flap, slip the card under it, and gently trim with a **new** blade, using the edge of the card as a straightedge. Do not press and you'll be able to use the card over and over.
Gene Britzius, Rockport, Texas



A common ball-point refill, when empty and cut and drilled as shown, creates inexpensive pushrod keepers for small models. We suspect a little heat forming to retain the bend will probably be necessary. *Levent Suberk, Bursa, Turkey*

Tech Tips

Basics of Scratch

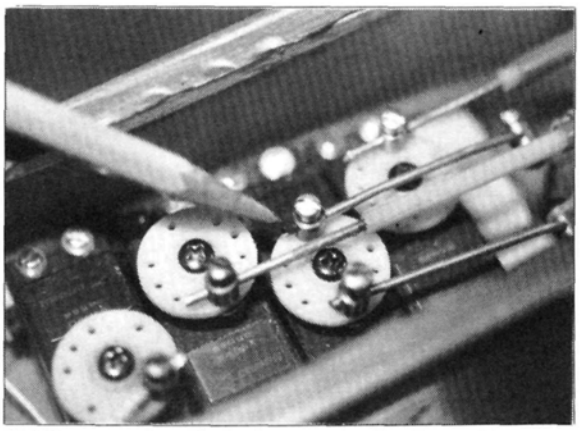
Increase the life expectancy of your model with a carefully planned radio installation.

INSTALLING a radio in a model is something that you'll take for granted after you've done it a few times, but in the beginning it's important to learn the basics. If you learn to do it right you won't have to go back and relearn it.

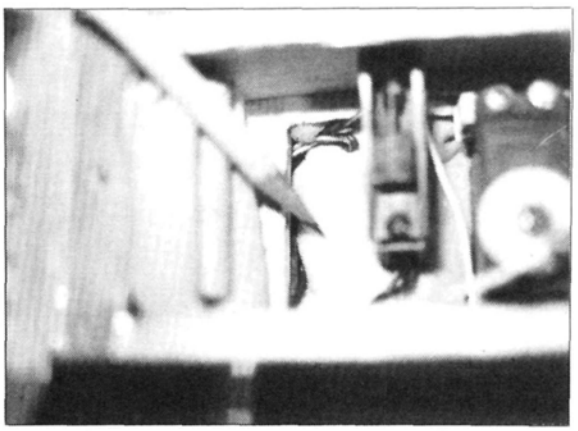
There are several major considerations to a proper radio installation, but the first one is balance of your model. Since the radio serves no aerodynamic purpose in itself, it's really "baggage." That baggage must be loaded according to the flight dynamics of the airplane, or in other words, the center of gravity or balance point. Not doing so will necessitate the addition of noseweight or tailweight to compensate for the shift. This becomes more dead weight that your airplane might not be designed to carry. Imagine getting in an airliner with all the passengers and baggage located in the rear. The airplane would look a bit strange taxiing out for takeoff with the tail dragging on the ground! Added to that, the pilot would be in for a big surprise when he finally got in the air. Well, your radio installation can bring about the same condition.

The ideal location for any excess baggage, such as a radio, is right on top of the balance point or CG (center of gravity). Naturally you can't put it all at that point, so you must spread it around. Just remember that weight is weight and no matter how you slice it, if you add 4 ounces of weight to the aft portion of the CG, you'll have to add the same portion to the fore section.

What about fuel? Here you have to

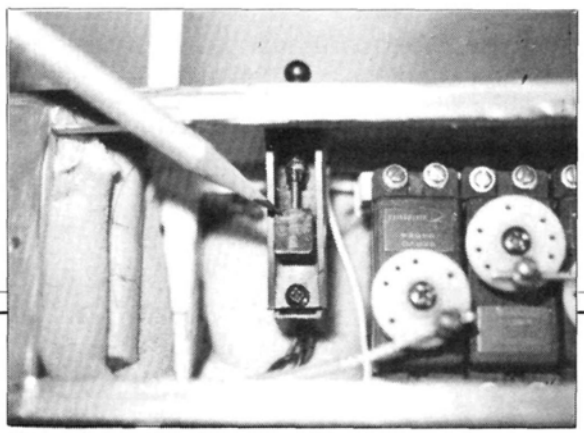


Full four-servo installation in a completed airframe. Note servo arm clearance and the use of swivel hardware to attach pushrods.



Foam padding is a protection against vibration for the battery. Natural rubber foam is the only type to be used.

Foam rubber is also used for vibration protection to the receiver. Do not pack tightly or protection is lost.



Use a switch holder whenever possible. This not only protects the switch from oil and dirt but is also much neater.

Building

PART IV

by Dan Santich

compromise. Since the weight of the fuel diminishes as you fly, you want to make sure your airplane balances before you add fuel. Even without fuel your plane should balance just slightly nose-down or nose-heavy, and *never* tail-heavy. If it is tail-heavy you're in for a wild ride at best and a crash at worst.

The servos are usually the heaviest part of the airborne "baggage," then comes the battery, then the receiver. Most radio installations in sport models have the elevator and rudder servos side by side at the rear of the radio compartment and the throttle servo just forward of these. Sometimes it's possible to put all three side by side. If you take three servos in your hand you can see that you have a substantial amount of weight to compensate for, and the farther they are from the CG, the worse the balance problem becomes since the room you have to work with forward of the CG is usually not abundant. It's therefore essential that you place the servos as close to the CG as possible and still have room for the receiver and battery.

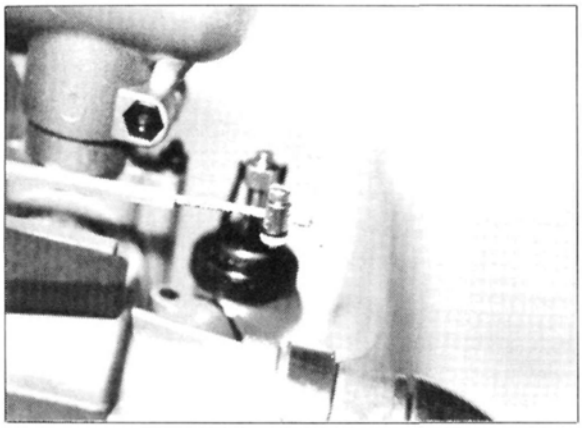
Since the battery represents the second heaviest part of the package, it's normally placed forward of the CG to compensate for the servos. When positioning the battery you can use it as a counterbalance to the servos.

But back to the servos. Servos are more than just little electric motors that drive the control surfaces. They are packed with precision gears and electronics, and need to be protected from engine vibration. On top of that, they must be secured so they don't move around when you want to deflect a control. Again we have a compromise situation. Because the servos are sensitive they must be protected from vibration, or at least some of it, by using rubber grommets to mount them. On top of that they should be mounted on the plastic servo tray provided with your radio, giving you a double buffer from vibration. Of course, with these buffers you will get a slight amount of play or servo movement, but it's usually not enough to cause sloppy control response. Never apply so much torque to the servo-mounting screws that you flatten out the grommets. In doing so you have lost most of their shock-absorbing ability.

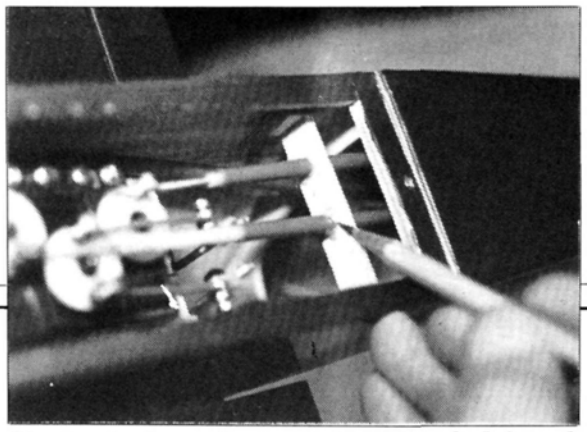
If you use the provided servo tray, make sure you mount it on hardwood rails and that the rails are secured to the sides of the fuselage with braces or triangle stock. Similarly, if your servos are mounted directly to the rails, make sure they're secured with braces.

The battery is next and it's normally located forward of the servos and close to the fuel tank. The battery must also be protected from engine vibration. It has very sensitive plates and chemicals inside it that can really be upset from abnormal

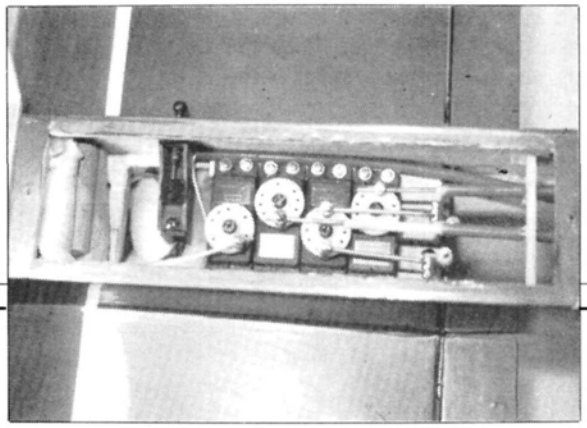
(Continued on page 120)



All pushrod linkages, whether to the throttle as shown here or to any flight surface, should be kept as straight as possible.



Nyrod pushrods must be supported at both ends. It is good practice to support pushrods in the middle during construction.



Antennas should exit the fuselage opposite the exhaust. The antenna should also be kept clear of servos whenever possible.

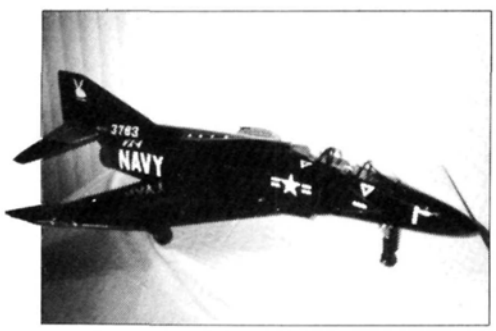
Jet Blast

by RICH URAVITCH

THIS MIGHT just turn out to be the year of the Phantom. The Tom Cook/Bob Fiorenze versions from Tom's kits have been widely publicized and have apparently planted the seed from which a number of offspring have sprung. The F-4 seems to have endeared itself to many folks and has already taken its rightful place in aviation history, for lots of reasons, like the P-51, P-47, F-86, and F-105. I've got a soft spot in my heart for this aero dichotomy, having rented a room in the "Rhino" a long time ago.

Anyway, the F-4s coming down the pike share a unique feature which separates them from the Tom Cook Version: they're all single-engine, which generally means smaller and definitely means simpler. The menu breaks into kits (or soon to be) and plans for the scratch-builder. One of the kits reportedly available now is being produced by Roy Hartmann* and was flown frequently at last year's Southwest Fan-Fly. I understand this machine is a rework of the old Duane Johnson design. It performs well with its single Byrojet/Rossi .81 power package and appeared at the SWFF as a Navy B or J version, which makes it equally usable as an AF C or D model.

The "B-Line"* folks out in Roseville, California, have taken pretty much the same approach with their version of the Phantom. It also uses a single Byrojet and the kit features a fiberglass fuselage 72 inches in length with a foam core wing spanning 52 inches. The reported flying weight is 11 pounds. I have no personal experience with the kit so perhaps some of you can fill me in.



Ziroli-designed F-4 for 4-inch Kress fan nicely executed by Kurt Wurster.

Roy Hartmann's F-4 Phantom which uses a single Byrojet/Rossi .81 unit was frequently and well flown at 1986 Southwest Fan-Fly.

Nick Ziroli* is working feverishly on his version which is designed around the 5-inch fan (Dynamax or Turbax) which makes it slightly smaller than either the Hartmann or B-Line offerings. Actually, Nick scaled up his original RK-20/RK-740 version, cleaned it up cosmetically, and it looks good. The kit will be all balsa with vacuum-formed inlet and exhaust ducts along with a radome plus a clear canopy. This is the kind of bird we need more of to interest newcomers: it's buildable and shouldn't cost a fortune.

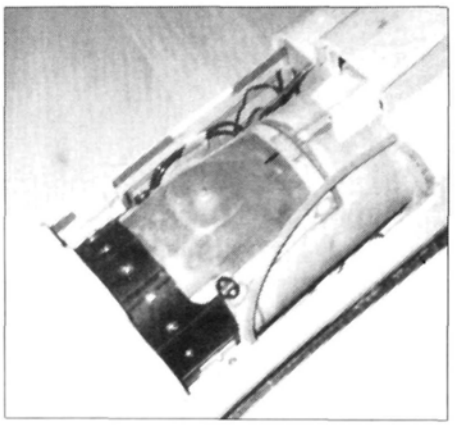
The next one is likely to be downstream aways but it comes from one of the "pioneers" of U.S. fan efforts, Larry Wolfe of Jet Hangar Hobbies*. A recent trip to the West Coast afforded me the opportunity to visit his shop for a peek at his F-4. It was in the plug stage when I saw it and it looked good. It's designed, quite naturally, for his Turbax series fan.

Scratch-designed and built sport scale Dynamaxed F-4 by Eric Baugher. MonoKote finish.

For the scratch-builders among you who "feel the need," the Ziroli Airplane factory still has plans available for the smaller RK-20/740 (4-inch) fan Phantom (or is that phan Fantom)? Regular

readers will remember that we followed that project through gestation and still continue to get pictures and favorable reports from guys who have already built them. One of the best performing is flown by Terry Best which we'll tell you more about in the upcoming SWFF "Jet Blast" Special.

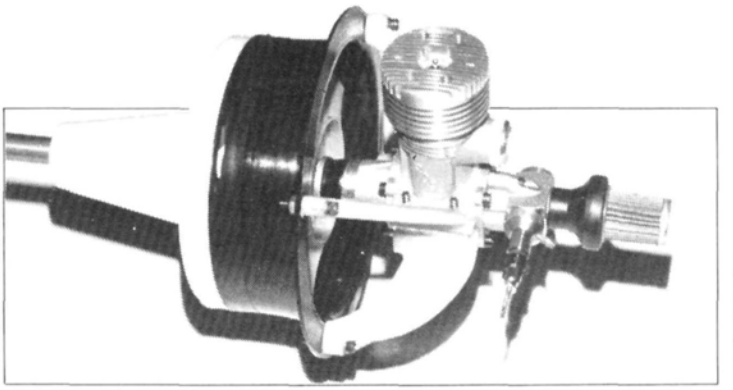
One of the prettier versions I've received pictures of was built by Kurt Wurster of Cincinnati, Ohio. Kurt finished his in the same VX-4 Playboy scheme used by Bob Fiorenze. Power



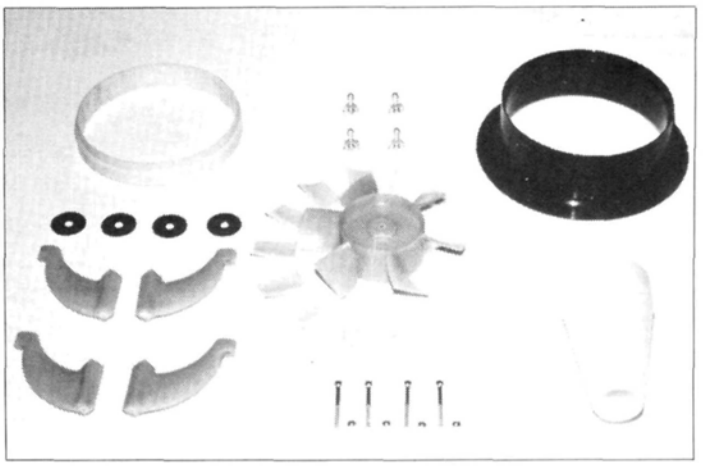
Neat Dynamax installation on Baugher F-4 Phantom. Note use of fiberglass.

comes from the Kress RK-740, Goldberg retracts clean up the gear on this 6-pound (wet) bird and performance should be great. Kurt also sent a photo of his scratch-built semi-scale Northrop F-5 which I think could be modified to resemble a creditable F-20. This one's also wrapped around the RK-740 fan. On the drawing board...an F-18 Hornet!

That represents those commercially available (or planned) Phantoms. Lack of availability (up to this point) has motivated some of you to scratch-build from your own plans, like Eric Baugher of Bowie, Maryland. Eric's version of the F-4 is a Dynamax-powered "sport scale" rendition which is finished in Navy "Sundowner" markings. Eric says its spectacular performance is attributable to a



RG ducted-fan unit available from JMI, 6-inch diameter pusher style for .60 to .90 engines.



Disassembled RG ducted-fan unit. Note six-blade rotor, 15-section stator and after-body fairing.

number of important things like weight control and proper inlet and exhaust design. The model uses an O.S. 77 driving the Dynamax fan to propel its 8¼ pounds at a brisk clip. Eric flies off grass and reports his F-4 is airborne in about 70 feet and really shines in the vertical. Nice job, Eric. Any plans available?

News from JMI* indicates they are importing the RG fan unit from Europe. This 6-inch diameter package is a pusher configuration similar to the Byrojet. It features a 6-bladed rotor and 15 fixed stator sections for flow straightening. JMI claims 12¼ pounds of thrust using a Rossi .81 turning 17,000 rpm. An interesting note here is that they've run tests with a "Davis Dieselized*" Rossi turning 18k and got 13-plus pounds static. A significant side advantage is the nearly 50% increase in fuel economy with the diesel. JMI promised more info when testing is completed. The fan unit is available now for $99.95 plus shipping.

Contest Calendar

All of you "phanatics" be sure to mark your calendars and make plans to attend the following fan activities:

June 6 and 7—"The Show Me 1987 Fun-Fly" sponsored by Kansas City R/C Club. For info contact Tom Cook, 304 Silvertop Raymore, MO 64083, 816-331-0356.

June 13 and 14—"Quinte '87 Fan Jet Rally" sponsored by Bay of Quinte Aeromodelers (Canada). For info contact Joe Leboutier, 5031 Old Stone Rd., Belleville, Ont., CA, K8R 1B9, 613-966-3566.

(Continued on page 76)

A sport airplane for .35 to .45 two- or four-stroke engines.

Easy

by Randy Randolph

Miss Nicole Ray charmingly displays dandy Randy's latest achievement.

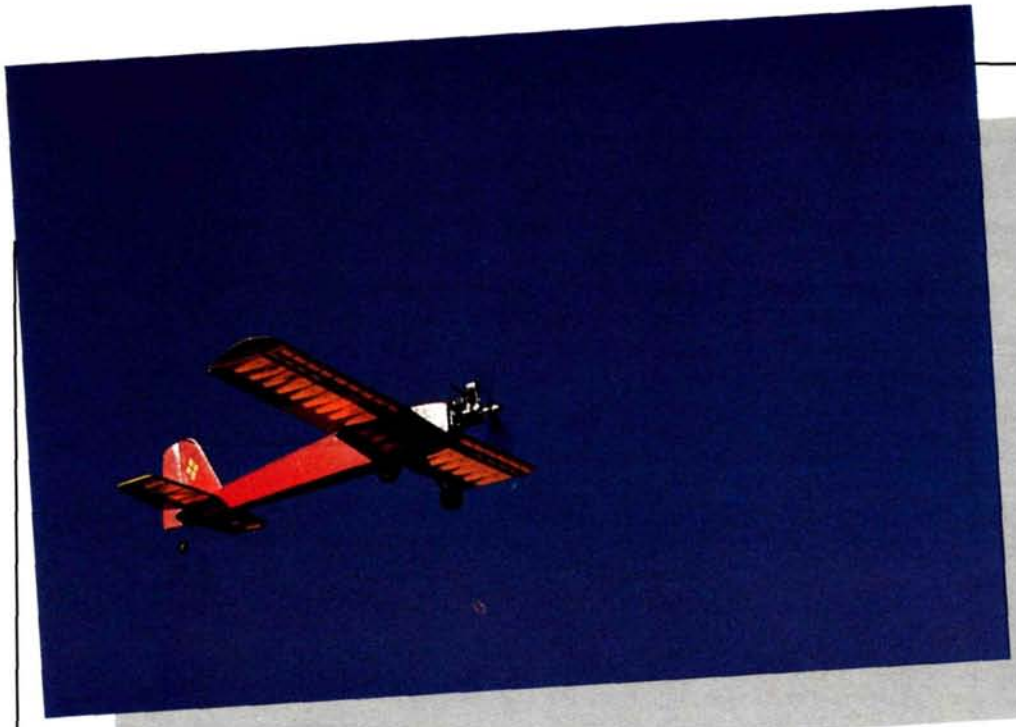
IT SEEMS THAT OVER THE YEARS the term "stick" has been applied to any R/C airplane that had a shoulder wing and no cabin. In that respect EASY qualifies as a stick and could have been so named, but I much prefer, simply, EASY.

EASY is a gentle airplane and a good one. In fact, for .40 to .45 four-strokes, they just don't come any better. It is light and strong and it builds rapidly. The substitution of a foam wing is about the only way to speed construction, but this would also add weight and is therefore not recommended.

The landing gear is the tried and true torsion bar type that is easy to install and withstands lots and lots of abuse. Being conventional, it also works better on grass fields than does the tricycle type. This is an airplane that is easy to maintain and the dings that come from a lot of flying are easily repaired.

As for flying, I have yet to find a maneuver it can't do, inside or outside. It will fly out of a dead stall with the addition of throttle and come down from altitude with a dead engine and full-up elevator to a safe landing. Free-flighters call that "de-thermalizing"! It's an "old man's airplane" that young men love to fly; and it's also my favorite.

CONSTRUCTION. As a general rule, the wings require the most construction in any airplane so they're a good place to start. The ribs are cut from 1/16-inch balsa sheet. They can be cut from a printed sheet made by tracing around a card stock template with a fiber-tipped pen, or they can be cut all at the same time by stacking balsa blanks together, tracing the rib pattern on top and sawing them out with a band or jig saw. When you go the printed sheet route, after they're cut from the sheet they should be stacked together and gang-sanded to smooth out any high or low places



Type: *Sport*
Wingspan: *54 inches*
Wing Area: *507 square inches*
Weight: *54 ounces*

that might have crept in during slicing.

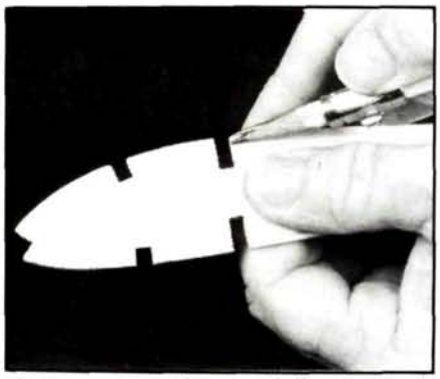
Select four ribs and trim 1/16-inch from the top and the bottom of each for the center section ribs. (An adjustable compass is a slick way to mark them.) Cut the webbs from 3/32-inch sheet and notice the grain. Webbs add greatly to the strength of the spars and add little weight. Strip the spars from the appropriate sheet wood. This can be done by using a straight edge and razor knife, or with one of the balsa strippers on the market. The choice of wood depends on the use. The spars should be cut from AB grain stock, hard for the main spars and medium for the other spars and the leading edge. The trailing edge sheet is also medium balsa. Slice the tip pieces from firm 1/8-inch sheet.

Cover the plan with wax paper and start building by pinning the bottom main spar in place on the plan, slip some ribs on the spar and use them to position the trailing edge sheet so it will match with any slight difference there might be in the length of your ribs and the plan. Pin the trailing edge in place and, starting with the second center rib, glue ribs and webbs in position.

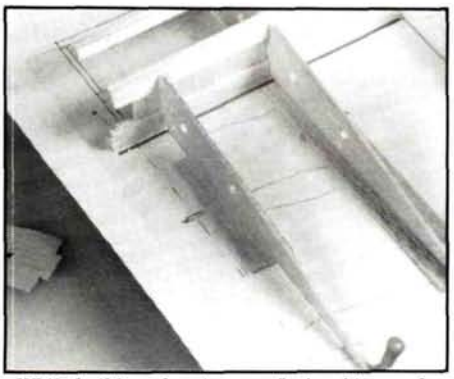
When all the ribs and webbs are installed, add the top main spar. Make sure that it is glued to all the webbs as well as the ribs. The front top spar can be installed at this time but don't add the top trailing edge sheet just yet; it will be installed after the wings are joined at the dihedral joint. Build the other panel in the same way.

The two center ribs are cut in half at the main spar and the two nose ribs are joined. The back half of these ribs form the sides of the well that will hold the aileron servo. The front of the well is the main spar and the back is scrap 1/16-inch sheet balsa trimmed to fit in between the ribs. Join the wing panels with the dihedral braces before adding the center ribs, the front bottom spar or the top trailing edge sheet. Then sheet the center section between the spars, leaving the bottom of the servo well open.

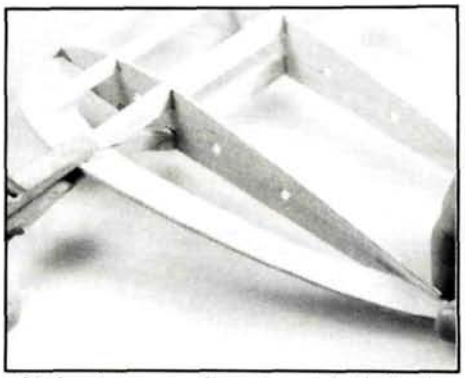
The ailerons are 1/4x1-inch stock tapered to 1/16 inch at the trailing edge. Stock can be purchased or sanded to shape. Two 1/2-inch pieces of aileron stock are glued to the trailing edge between the last two ribs and sanded to blend into the tips.



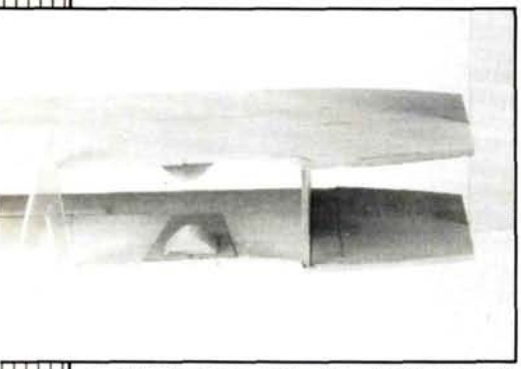
An easy way to mark center ribs for trimming is with a school compass. Point acts as a guide.



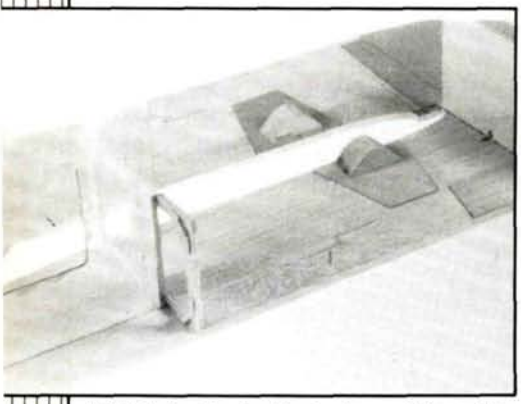
While building the wing, use 1/16-in. shims under center ribs to hold them in position until glued.



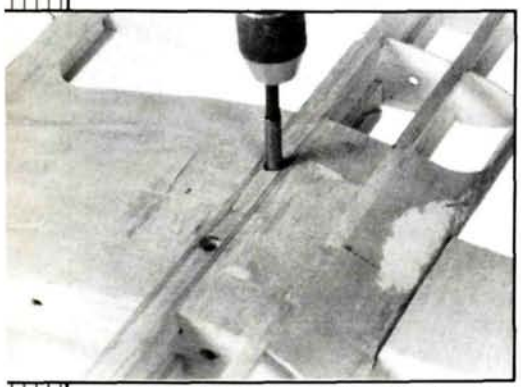
Clothespin is an excellent clamp to hold wing tips against trimmed top spars until glue is applied.



A right triangle is employed to aid alignment. If all sides are square, the fuselage is true.



Right triangle should also be used for cabin former installation to aid fuse alignment.



Drill 1/4-in. holes between joiners for wing bolts. Shim holes with 1/4-in. o.d. brass tube.

The aileron torque rods are made by slipping 1/8-inch brass tube over the 3/32-inch music wire and then bending to the shape shown. Note that there is a left and a right. Mark the location of the torque rod arms on the trailing edge at these locations with a piece of rolled up sandpaper to give the arms free movement. Glue the brass tubing in place on the trailing edge being careful not to get any glue in the tubes, and check that the left one is on the left side, and so forth.

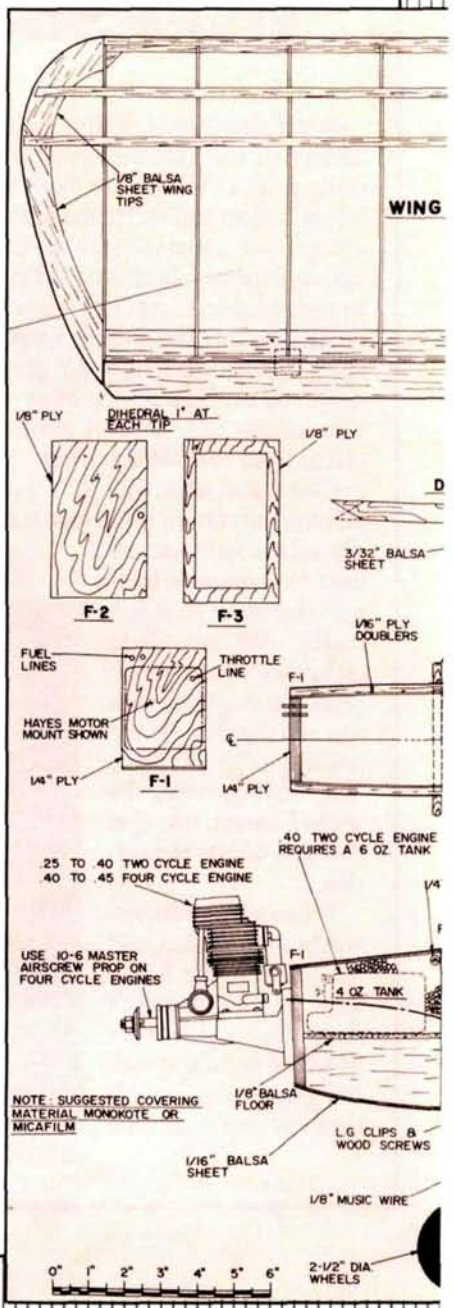
Hold the ailerons against the torque rods and drill the leading edges to match the barbs on the end of the rods. Slightly hollow out the leading edges from these holes inboard to allow the torque rods to seat and close the gap between the ailerons and the wing. The ailerons are mounted after they and the wings are covered. Use epoxy to secure them to the torque rods.

Mount the servo on a plywood tray that is glued to scrap balsa risers at both ends of the servo well. Standard aileron hardware is used to connect the aileron horns to the servo.

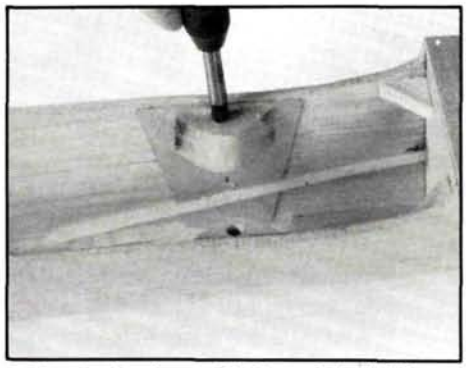
The tips are glued to the two tip ribs. Notice that they slant up to become flush with the top of the top spar stubs.

The stab and rudder are built right over the plan just as the wing. The two 1/32-inch plywood spar doublers shouldn't be eliminated because they add much strength in this area. The plan shows 1/4-inch-square hardwood for the elevator carry through, but 1/4-inch dowel will work as well. When complete, join the mating surfaces and sand the outlines to match.

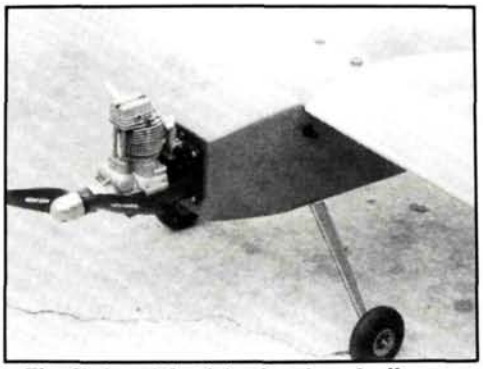
The fuselage sides are cut from medium to soft 3/16-inch balsa sheet. Edge-glue three, 3-inch sheets together to make both sides. The doublers are 1/16-inch plywood. When the doublers are cemented in place, pin the two sides together and sand them to the same outline with a sanding block and 100-grit sandpaper. While they're still pinned together, cut the wing saddle and drill the 1/4-inch holes for



FOR ORDERING INFORMATION, SEE PAGES 132, 133



After wing blocks are drilled, tap with a ¼-20 tap. Plan shows rubber band mounting as well.

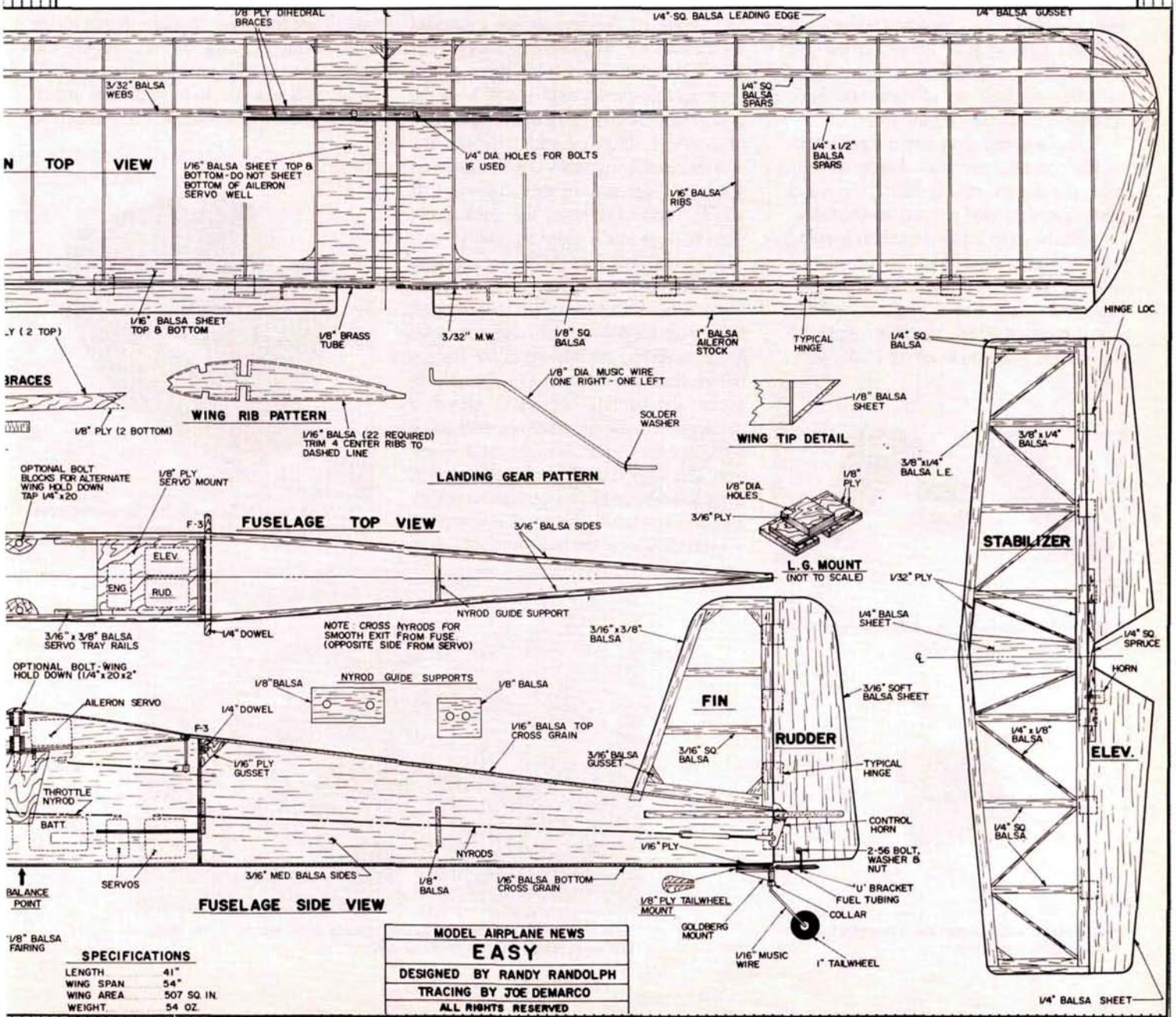


The U-shaped bend in throttle rod offers easy adjustment while the engine is running.

the wing holding-dowels if that method is to be used.

Separate the sides and add the servo and tank mounting-rails. Cut out and drill the firewall and the two cabin formers; epoxy T-nuts on the backside of the firewall for the mounting bolts and start

(Continued on page 106)



Helicopter Cha

by CRAIG HATH

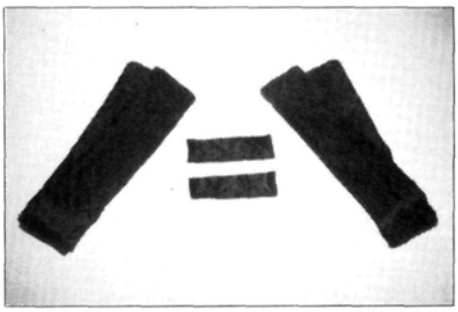
IF YOU HAVEN'T been following this column, allow me to re-cap a little before we jump into the next installment. Initially, I covered what some of the more popular beginners helicopters were along with a little information about what to look for when purchasing the first model and accessories. Then I covered the area of tools and building equipment. In the last issue I started covering the actual kit construction. If you're just getting off to a start, perhaps you should consider getting your hands on the last four back issues of *Model Airplane News* to bring yourself up to date and have reference material to draw from.

Now, jumping right into the next steps of kit construction: you should already have the engine run-in, all of the wood parts assembled and painted, and be familiar with the parts list to at least understand what the parts descriptions in the manual refer to. You'll be ready to begin assembling the main frame and sub-frames. The important thing to keep in mind with this step is that you keep all of the parts square as you tighten fasteners and add components. The main frame assembly is the basis for the balance of the mechanics and care needs to be exercised here so that parts alignment can be accomplished without extra effort.

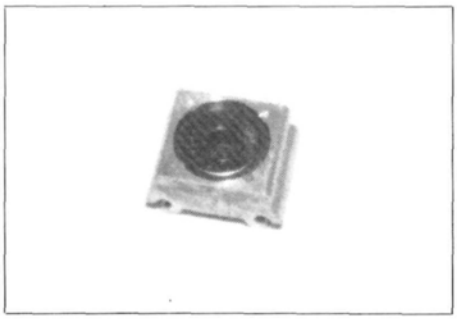
My method of assembling the main and sub-frames begins with the frames standing up on the table; addition of the crossmembers is next, and then the sub-frames are added along with the front bed. None of the screws are tightened until all of the alignment is acceptable. The best way to accomplish this is to just snug up the screws until it will hold the part in place. Go over all of the parts for a final check, then carefully tighten the screws alternating from side to side so as not to change any of the alignment. If you're successful here, the subsequent steps will go much more smoothly.

A special note for GMP Cobra owners is to obtain a set of main frame reinforcements from one of the aftermarket helicopter suppliers. The reinforcements are attached to the bottom of the frames where they are bent at a 90° angle to accept the landing gear. This area is a weak point in the structure and will crack with repeated bounces and excess vibration. The angled steel reinforcements will greatly increase the resistance to cracking and are well worth the small investment.

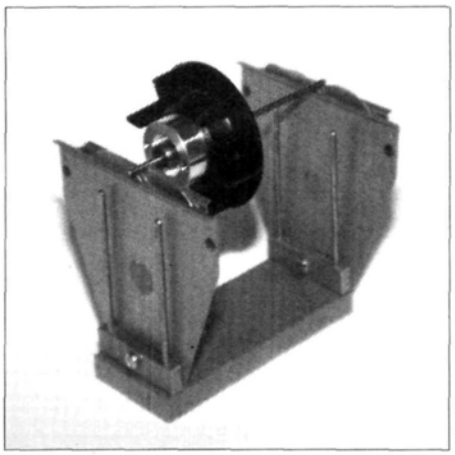
Once you have the main and subframe assemblies completed, the next step is to add the various blocks that house ball bearings for the main shaft, clutch pinion, and tail drive gear. Whenever you put a ball bearing into any housing always use a thread-locking compound like LockTite to keep the bearing from spinning in the block. A dry or spinning ball bearing can be a source of radio interference. Another step that you can take is to stake the bearing into the block with a pin punch or small chisel. This is only possible on aluminum bearing blocks. When the blocks are placed in frames, the instructions will tell you to temporarily attach them to the main frames. The reason for



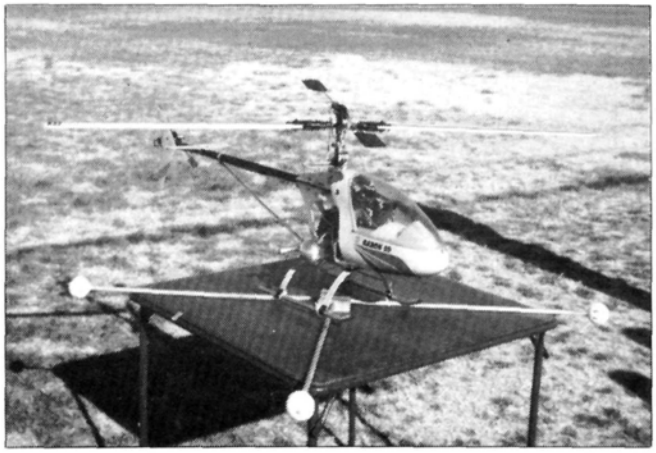
Yale Hobby Manufacturing produces quilted blade covers for main and tail rotors.



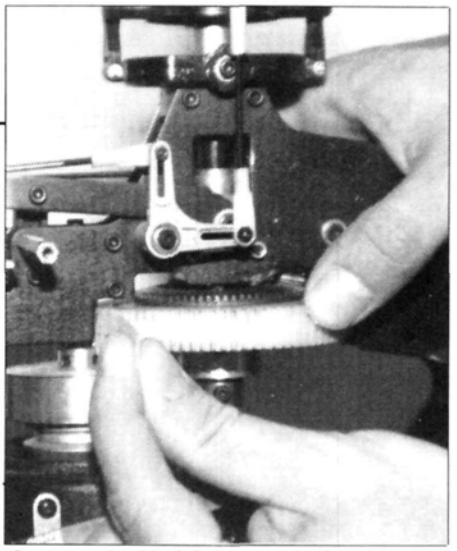
Ball bearing stacked into an aluminum block to reduce radio interference.



The High Point Balancer is an effective balancer. Here a cooling fan is being checked.



Yale Hobby Manufacturing's new training gear will save you many dollars in parts; see text for more details.



Setting up backlash between main drive gear and pinion. Notebook paper makes clearance right.

Dick Meeker is showing off his new after muffler on a Baron 28. Simple arrangement uses a tin can and a piece of silicone hose. Very quiet.

Our columnist has just completed this all-out competition Baron 60 with many options. It flies very nicely.

this is to leave the block-fastening screws loose in the frame so that the blocks can be properly aligned later. In most cases, there appears to be no room for any kind of adjusting because the mounting holes are the same size as the screw, and they're not slotted. You'll be amazed at the amount of play that these holes allow when the fasteners are loose. At any rate, alignment gets covered in the next step.

Now the frames are ready to accept the power unit assembly—the next "sub-project." Expect to spend a little extra time in this area, and never force anything to fit! The power unit entails the engine, cooling fan, clutch, and starting shaft. There are two critical aspects of this assembly. One is the balance of the parts that you add, and the other is called run-out.

Balance is approached first, since most of the parts will be balanced before they're assembled. This is where the high point balancer will come in handy. Always check the cooling fan, clutch hub, starting shaft, clutch, and clutch bell for balance before you assemble them. I usually place the part on the balancer and allow the heavy side to fall. Next, I mark the heavy side with a felt tip pen, and then remove the part from the balancer. I use a large drill, say ⅜ inch, to dimple the part at the heavy point. Go easy with this process, and continually re-check the part until it will stay in any position on the balancer. I'm sure most people feel that this is overkill, yet I know it has kept me from having to trouble-shoot many a power train vibration in the past.

Run out refers to the trueness of the rotation of the part. In this case all parts are attached to the crankshaft, and these parts must spin without wobble. The tolerance for run out is very small due to the high speed that the engine turns at (13,000 to 17,000 rpm).

Run out is measured in thousandths of an inch, and anything over 2 thousandths is unacceptable. The result of excessive run out is severe vibration and extreme wear on the bearings and shafts themselves. In the manual you are normally given the procedure for setting the starting shaft and clutch on the engine (usually clamped into a vise, and then turned while a fixed pointing device indicates the run out). If you have access to a dial indicator and base, by all means use it! Note that this does not apply to belt-started helicopters, as there is no starting shaft to align. However, it is still not a bad idea to check the run out of the cooling

(Continued on page 123)

Floating Around

by JOHN SULLIVAN

Bill Curry's ¼-scale Nieuport 29 taxiies out. Float mount utilizes existing gear with added N-strut. Rear float is fixed as high-rate air rudder has adequate control authority. This is a beautiful airplane on land or sea.

JUST IMAGINE that you live in a small town where every household has at least one radio-control floatplane. In the morning, you can step out on the front porch of your lakeside cabin and listen to the early-bird modelers running their engines up in the pits at the shore's edge. For breakfast, you stroll through a grove of willow trees to the restaurant next to the flightline, and there you eat ham, eggs, home-made sticky buns and then drink coffee out on the dock. A 10-foot PBY 5A Catalina bobs at its mooring 20 feet offshore and a four-stroke Canadair twin breaks the water and starts a flat wide turn straight out from your table.

By 9:00, the P.A. system is on line and the impound area is filled with over 110 floatplanes of every size and description. There's no competing here. You can sit in the California sun and watch it all from the bleachers, or gas-up on the dock, set your plane in the water and do your thing. If you happen to run out of gas, don't worry. Just glide back down and land anywhere you want, because there's two chase screws in boats to retrieve your plane and bring it back to shore.

Does this sound like a dream? It's a real occurrence each year when the Clearlake Modelers put on their annual Float-Fly, the biggest exhibition of float planes anywhere—Last year I spotted club jack-

Lee Palzolo's WACO UBF-7 from a Pica kit. Note float spread in relation to wingspan. Ship is red and white scalloped and is powered by an Enya R-120.

Balsa USA Der Jaeger bipe flew beautifully at Clearlake Float-Fly.

ets from five western states—and the Clearlake club really knows how to put on a bash. This year the Float-Fly will be bigger than ever. The City of Lakeport has installed another run of docks, extending the flight line to 400 feet. The club members have been busy lining up prizes, improving the P.A. system, setting up spectrum analyzers, installing 110 outlets at the pits, organizing a Saturday night barbeque and printing T-shirts and hats since December. To make a good thing even better, the city of Lakeport is a resort community with hundreds of lakeshore cabins, motels, and RV hookups right on Clearlake, so affordable accommodations are available at or near the site.

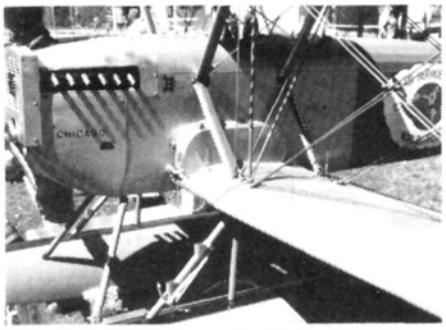
The dates this year are May 8, 9, and 10 (Friday, Saturday and Sunday) and the meet is held at the City Park in downtown Lakeport, California. This is an AMA-sanctioned event; the C.D. is Art Young, whom you can call at (707) 994-6402 work, and (707) 998-1224 home for more information. If you're at the end of your rope, this is a great place to drop off!

This month we're going to take a look at biplanes on floats. There's an old adage that says, "real airplanes have two wings and round engines" and, as you can see from the pictures, it doesn't hurt appearances any to add a couple floats to the mix. The sight of a biplane on floats executing a big barrel roll is nothing short of majestic. There's nothing difficult about adapting a biplane to floats.

The basic tenants of putting the step under the c.g. and aligning the float decks parallel to the flight line or stab still apply with the exception of the three-point types seen on Proctor Antic and the Nieuport .28. Bill Curry and I made the floats for the Nieuport from scratch. We picked a profile for the floats from some photos of early Boeing types which looked pretty much like parallelograms with the stern rounded down and the bow rounded up. Because the deck and underside of the floats were parallel we were forced to mount the floats at a 4° positive incidence in order to provide a bottom rake which, in turn, provides a step for the plane to come up on without leaving the forward portion of the floats submerged.

Proctor Antic Bipe with .40 four-stroke power glides by. This is a very relaxing combination that will provide enjoyment for years.

Mounting the floats on the Nieuport was a snap as we were able to use the existing landing gear with only the addition of a spread bar and a forward N strut to maintain rigidity. For the first flights, we coupled the rear float to the steerable tail wheel system but the bulk and weight of that float made it impossible to keep it in rigid flight. The fix involved mounting the rear float rigid and relying on the Nieuport's huge air rudder for maneuvering, which has proved adequate even in high winds.



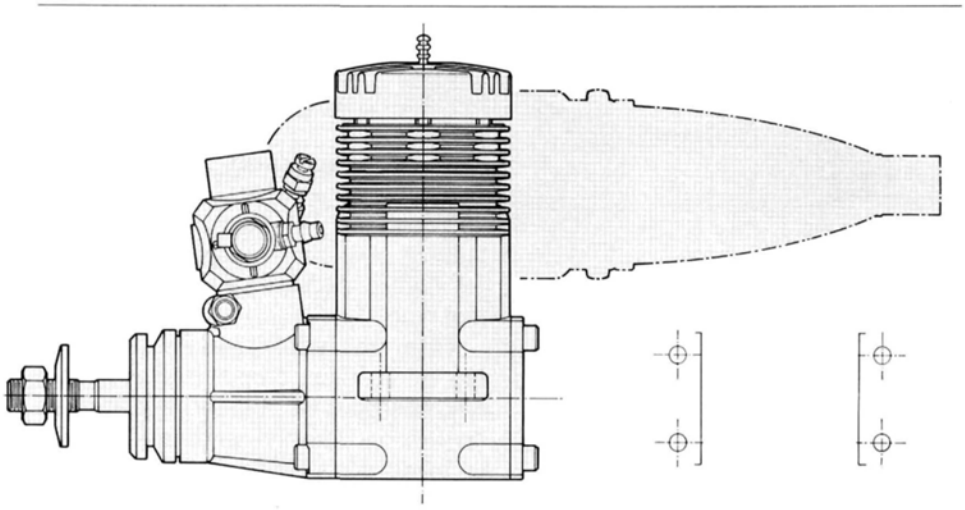
Dick Hershey's Douglas World Cruiser is loaded with detail.

While on the subject of windy conditions, consider the biplane's reaction to crosswind conditions while taxiing. With any floatplane, it's the side area, initially, that contributes to the craft's blowing over. I think it's safe to say that biplanes have side area equivalent to mono-wing planes, but they generally have much larger wing areas, and once the wind gets under that surface, things begin to progress geometrically. It's important, then, to mount your floats with the floats spread to the high side of the 20 to 25 percent usually recommended. The other thing to remember is that an aileron can be used to great advantage to hold an upwind wing down. Learning to do that is a requirement for getting a full-scale float rating so remember to couple your water

(Continued on page 76)

How to Operate and Care For Your R/C Glow Engine

by DAN SANTICH



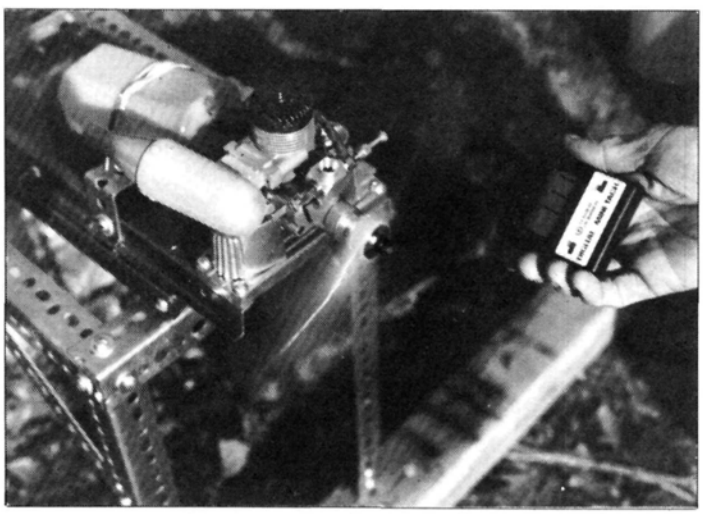
MODELERS TODAY are blessed with a marvel of engineering, the glow R/C engine. Rarely, if ever, do we have to worry that the engine we purchase won't perform to our satisfaction or will wear out prematurely. Modern engines are highly developed pieces of engineering that are produced at exacting standards. However, not all engines are tested before they leave the factory. It is therefore essential that you not only know how to choose an engine but how to care for it once it is in your hands.

Picking an engine may seem to the unknowledgeable a little like playing Russian roulette, particularly if he listens to some of the horror stories from even less experienced modelers. "That engine ain't worth nothin'," one might exclaim after a crash in which his engine quit on takeoff. But what he didn't say was that he forgot to fill the tank! It's always best to listen only to advice from experienced modelers. They've already been through many of the problems you're going to encounter. But as to picking the right engine, 99% of all new engines sold today will give you many hours of trouble-free flying. All *you* have to do is observe some basic rules of engine operation and break-in.

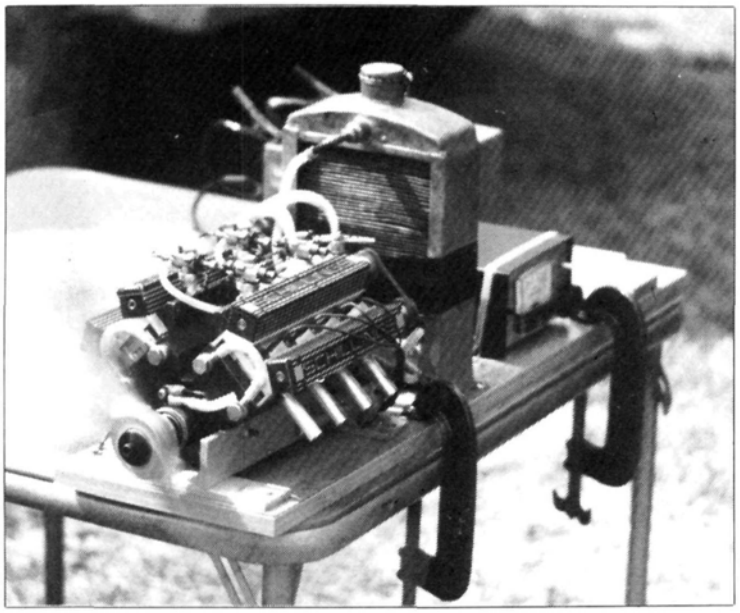
Most engine manufacturers no longer find it necessary to run every engine prior to selling it. Fox is the exception to this, however. They pre-run and set up *every* engine they sell. The other engine makers sometimes miss a defect or a small bit of metal that can spell a very short life for your investment. A case in point was the OPS 60 I tested for the "Big Gun Shoot Out" in the April '86 issue of *M.A.N.* I found metal shavings in the crankcase and had I not checked it prior to running I would have had a real mess on my hands.

Over the years I have experienced similar conditions with new engines, which is why I take the time to remove the head, backplate, and carburetor and flush the engine out with kerosene prior to running it. All it takes is one time for the piston to go up and down with a piece of metal shaving between it and the liner for you to have a ruined engine. While you have the head and the backplate off, and after you have flushed it out completely, slowly turn the engine over by rotating the crankshaft. It should feel smooth throughout the rotation. If it doesn't, you either have a bad set of bearings or they're misaligned. You could also have other problems such as a rod that is tight or a piston and liner that are mismatched, although ABC engines normally seem tight, particularly at the top of the stroke. If it is an ABC engine, the bottom end is usually the only thing you need to check for freedom of movement.

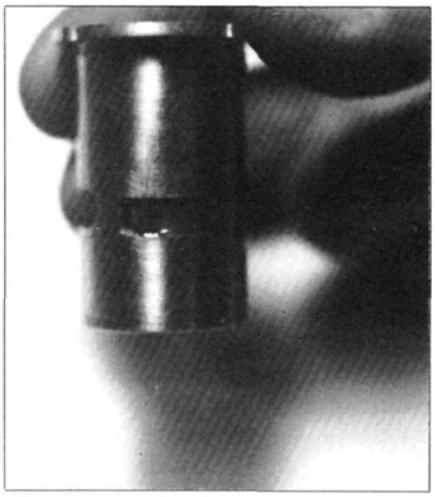
If you have a ringed engine that is tight, it's possible that a rod is hanging up. I had this problem with an O.S. 160 twin, and I thought that by running the engine I



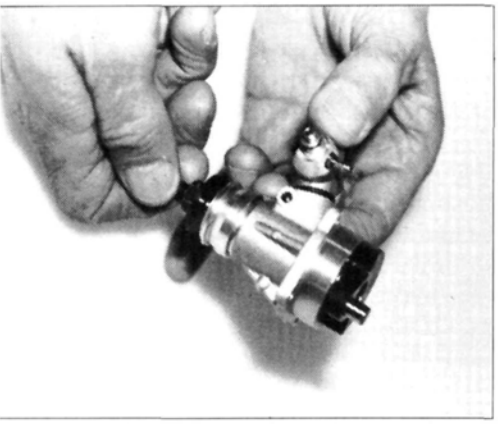
A tachometer is useful in determining best needle valve settings. Effective and easy to use are digital types; here Tower Hobbies' Digital Mini-Tach.



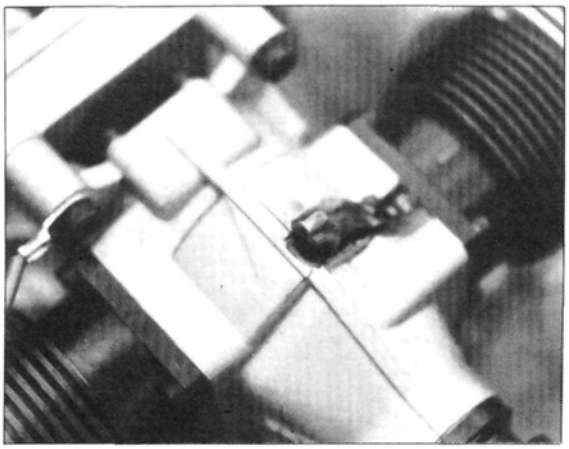
Engines as exotic as the Schillings eight-cylinder require break-in and test running. Note use of water-cooling radiator.



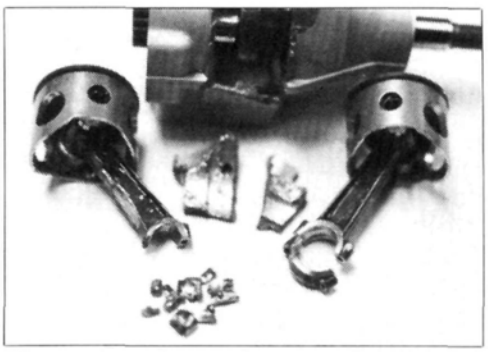
Clean fuel is a must. Note damage to the port edge caused by some foreign matter carried into the engine.



The front bearing and crankshaft should be checked carefully for proper alignment and rotation.



Note damage from a tight connecting rod in this O.S. 160 twin. I should not have run it.



This will give you insight into internal damage that can be done when an engine is not properly set-up.

would help the engine set itself. Well, what I ended up with was a rod coming through the crankcase! For this reason, you should never run a new engine that seems unnaturally tight; something is wrong. Remember, you have the option of exchanging it with another engine if it doesn't seem right to you. If you do run it and throw a rod or freeze it up, you may have a hard time justifying the damage to the manufacturer. Not only that, but you could end up losing your airplane and radio in a crash caused by engine failure in flight.

There are three main enemies to the R/C glow engine: heat, foreign debris, and corrosion. Let's take corrosion first, although you won't have to worry about it for a while. At least not until after your first run!

There are several causes for corrosion, but the common denominator is moisture. Methanol, the primary ingredient of our fuel, burns very clean but has little or no lubricating qualities. For this reason, fuel makers add lubricants such as synthetics or castor oil, or both. To boost the power of the burning process of the methanol and lubricant, a small amount of nitromethane is added, usually in 5% or 10% ratios. The formula used for most sport type fuel is 25% oil/70% methanol/5% nitromethane. Corrosion in your engine is formed, or at least the stage for it is set, when you fail to run your engine dry at the close of a flying session. The fuel remaining in your engine will evaporate, thereby attracting moisture. The remnants of these components will set off a chemical reaction that will lead to rust and eventual destruction of your engine.

(Continued on page 111)

Repairs

Basics of Radio Control

by RANDY RANDOLPH

MAINTENANCE is an important part of keeping an airplane in flying condition. After every flying session the engine should be wiped clean and a good oil (Marvel Mystery) squirted into the intake and exhaust ports. All mounting bolts should be checked and tightened if necessary, all linkages inspected, and the whole airplane cleaned with one of the glass cleaners.

This cleanup provides an opportunity to inspect the covering for the dings and dents that are caused by stubble, pebbles, and twigs. If one of the heat-shrinkable plastic films is used, dents can be cured with the application of heat to the affected areas. In the case of a small tear, a patch of the same material should be ironed on. Now, let's consider the more serious dings that cause minor structural damage.

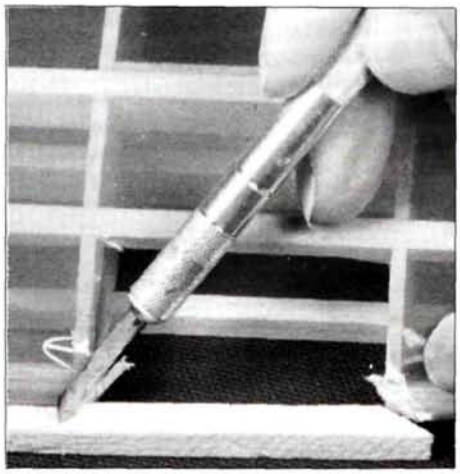
Probably the most common damage is done to wing leading edges. Posts, trees, stumps, and fences seem to jump in front of airplanes and leave an impression of themselves in the leading edge. As long as the main spars are undamaged, the repairs in this area are not too difficult and are almost invisible if made carefully.

Built-up wings fall into two categories: those with leading-edge sheeting and those without. The sheeting provides some extra strength, but its chief function is to keep the airfoil true between ribs. Often there will be two or more small spars just behind the leading edge for the same reason. These two types of leading edges require almost the same repair techniques.

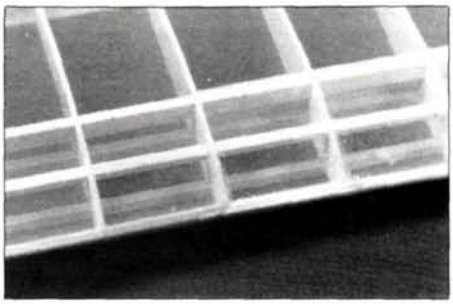
First the covering must be cut away from the top and bottom to expose the damage. Cut to the first undamaged ribs and back to the main spar or wherever the covering is still well bonded to the framework. Don't leave areas of unsupported covering. They will not make good bonding points for the replacement covering when the repair is complete. Once the damage is exposed, the repair can begin.

Whenever splices are made in wood,

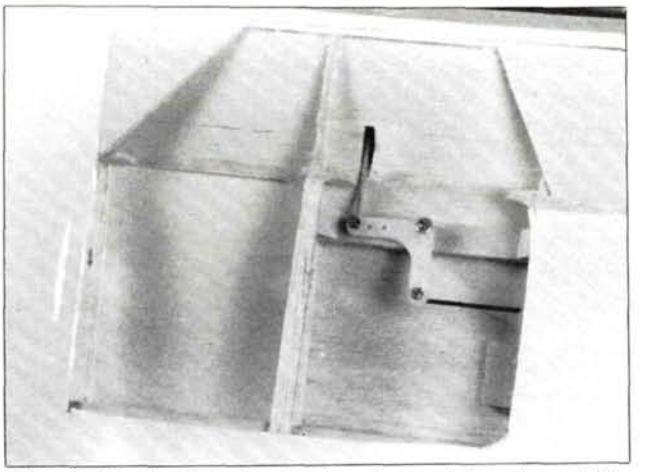
First step in any built-up covered repair is trimming to expose the damage.



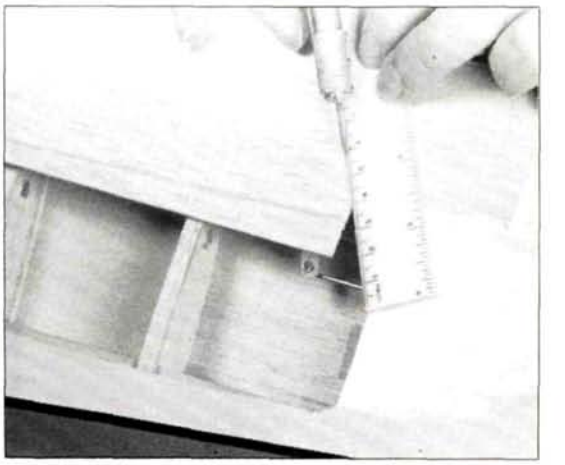
Damaged area is replaced with new wood. Structure trimmed away at an angle for more glue area.



Repair blends in with the rest of the wing when done properly.



The principle of angled cuts applies to replacement of sheet areas. This trailing edge sheet was attacked by an unruly trunk lid.



A ruler makes a good cutting template for replacement sheet when matched against the proposed cut.

the two pieces to be joined should be cut so that as much gluing area as possible is available. Do this by cutting both pieces at matching angles of 45° or less. With this in mind, cut away the damaged area of the leading edge at an angle slanting toward the damage on each side. If sheeting is involved, trim away the damaged sheet the same way, again at an angle.

In some cases it's possible to use the cut-away material as a template for shaping the replacement, and this is especially true of sheeting. For the leading edge itself, however, the replacement is a cut-and-fit proposition. This is not as difficult as it sounds. First cut the replacement slightly oversize, then hold it just below the position it will occupy and trim it a little at a time until a good fit is secured. Use a gap-filling cement to take care of any voids. Once the new material is cemented in place, sand it to match the old structure with a sanding block and 150- to 320-grit sandpaper.

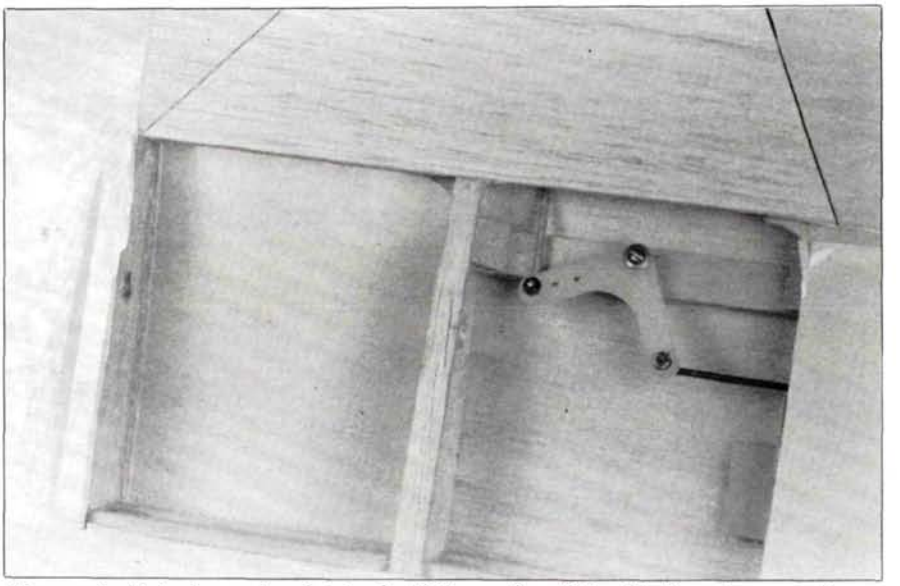
Cut the replacement covering material so it is at least ⅛ inch larger all around than the area to be covered. Position it, then iron it to the spars, ribs, and leading edge. Shrink it from the center out and try to avoid putting heat on the overlaps. Cover the top and bottom with separate pieces of film. Check the seams and if any have raised iron them back in place.

Fins and stabilizers can be repaired the same way. Just remember to make all splices angled with plenty of gluing area and the joints will be good ones.

Although most damage is done between ribs, occasionally a rib will be involved. When this happens it's handy to have a template of the rib so a duplicate can be made. Therefore, before starting construction on any new airplane, make an extra rib and put it aside for just such an eventuality.

The methods described for built-up wings apply to foam wings as well. The only difference is the substitution of a solid foam wedge trimmed to fit the damaged section cut from the leading edge. If the wing is sheeted with balsa the replaced foam is sanded to shape and covered with balsa sheet just as the built-up wing. Always use white, or aliphatic resin, glue on foam. Epoxy will work but is quite heavy.

Randy Randolph, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. ■



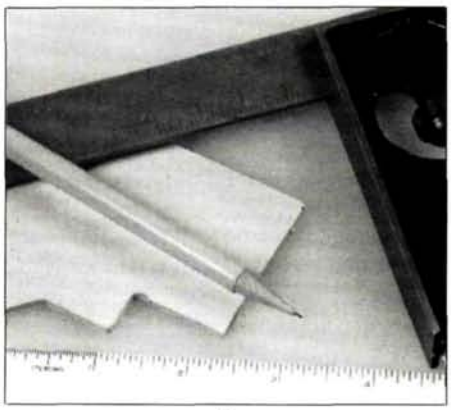
The new sheet is in place and ready to be glued. The use of gap-filling CA glue and some sandpaper will blend the repair into the rest of the wing.

How To:

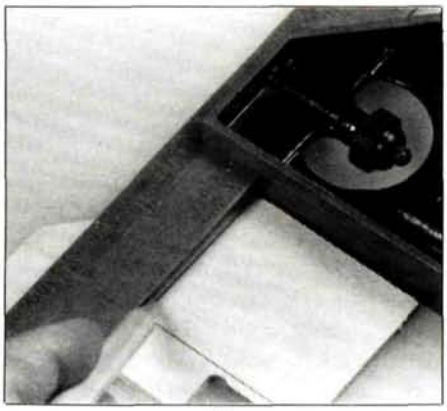
by RANDY RANDOLPH

MAKE A RIB JIG

Proper wing construction requires that all ribs be installed vertically to the plane of the wing in order to maintain the proper airfoil section. Not only do slanted ribs cause deviation in the airfoil, but they look bad and are a sign of poor workmanship. The simple jig described in the photos makes proper installation automatic.



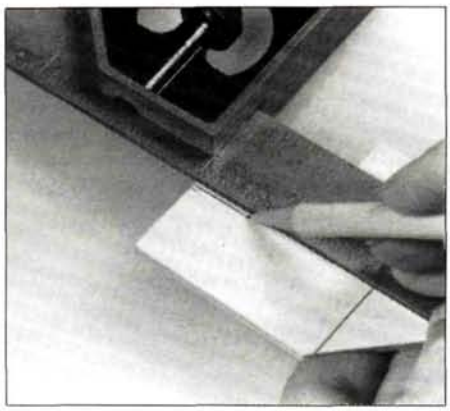
1.



2.

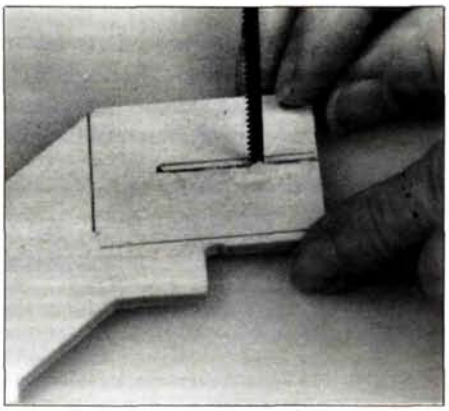
1. The tools and materials required are scrap plywood, a square, a pencil, and a ruler. For ¼-scale airplanes the plywood should be at least 4 inches square.

2. Use the square and mark off a rectangle that is at least 2 inches on a side. Make sure that each side is square with the others.



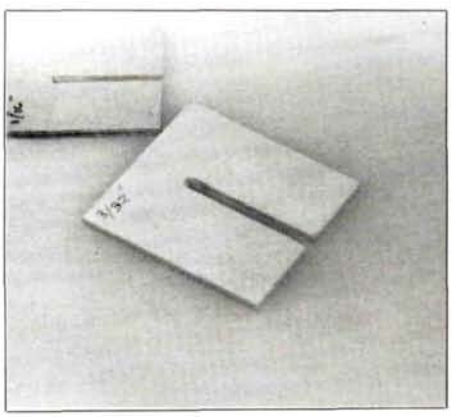
3.

3. Find the center of the bottom side and use the square to draw two parallel lines 1½ inches long, 1/16-inch apart. These lines must be square with the bottom for an accurate jig.



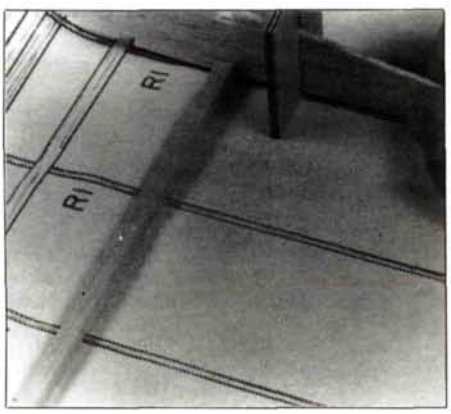
4.

4. Saw out the 1/16-inch notch, then cut the rest of the jig from the plywood. For larger airplanes with deeper ribs, the jig measurements must be increased with the notch at least ¼-inch deeper than the deepest rib.



5.

5. The completed jig. It is necessary to make a jig for each rib thickness, these are for 1/16-and 3/32-inch ribs. The width of the notch must be as close to the width of the rib as possible for best accuracy.



6.

6. To use the jig, assemble the bottom main spar over the plan. Slip the jig over a rib, then hold it flat against the plan while the rib is glued in place on the spar.

.40 ENGINE

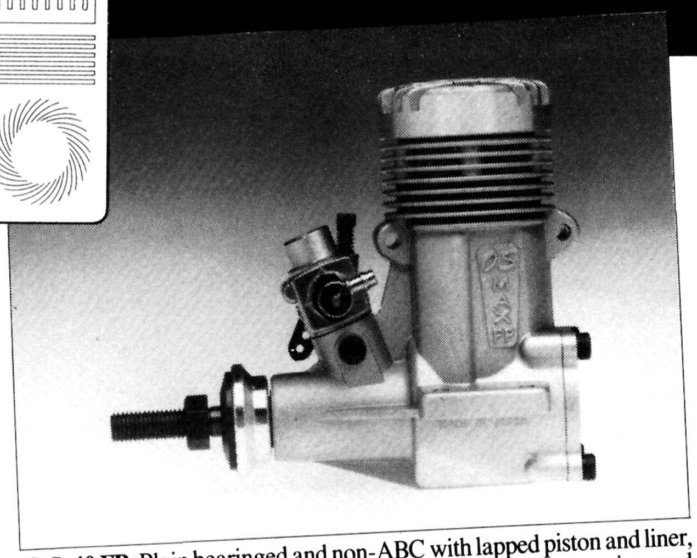
The best of 'em duel it out on the .40 front!

THERE ARE few products I can think of which contribute as much to the hobby as the .40 cubic inch model airplane engine. This is the best-selling engine there is and for a good reason—economy. Economy alone, however, doesn't spell the full formula of acceptance by the modeler. Where other products find a place in our workshop or airplane due to gimmickry or technological parity, the .40 engine has found its way as an almost "staple" item. It

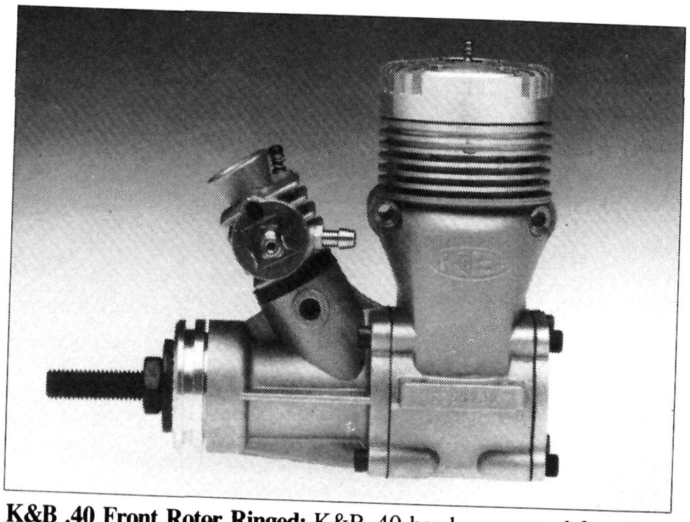
SHOOT-OUT

is something nearly every modeler owns, and if he doesn't, he most likely will at some point. Why? Because this engine fills a need that is beyond the realm of pure economics. That need is really what the hobby is all about in the first place—creativity.

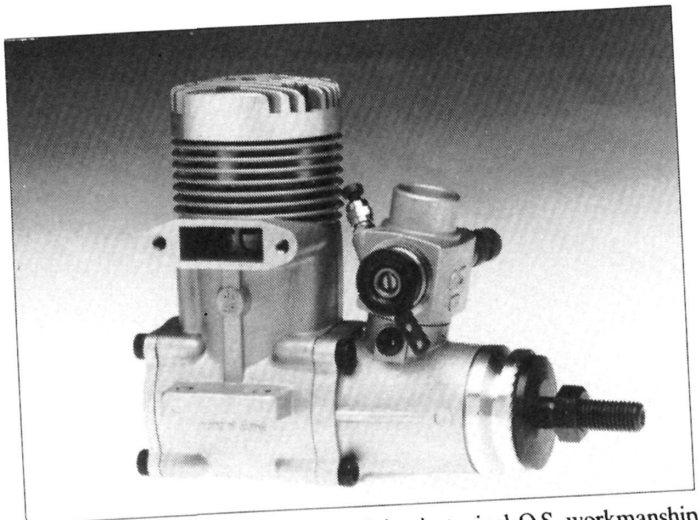
The hobby prospers because of our imagination and need to express our creativity, and the .40-size model airplane engine gives us both the means and the method of our success. It is the most popular size engine for trainers as well



O.S. 40 FP: Plain bearinged and non-ABC with lapped piston and liner, non-ringed Schnuerle-ported. Economical in purchase price and operating cost, it takes a bit more break-in time since it is without ball bearings. When broken-in, performed well and idle was superb.



K&B .40 Front Rotor Ringed: K&B .40 has been around for a long time, which says this little engine does the job. A well-made jewel that handles like a puppy, performs like a thoroughbred. Features a ringed piston (Dykes), ball bearing-supported crankshaft, and a new K&B carburetor that's easy to set. Low price doesn't really correlate with performance, which was quite surprising.



O.S. 40 FSR Ringed and ABC: Maintain typical O.S. workmanship throughout. Have good power. First-flip starters, they held any rpm setting on the carburetor. Easy carburetor adjustments and docile operating qualities. Both use ball bearings on crank. Time-proven engines.

as sport models, and its future is unquestionably good. In fact, it is so good that manufacturers have spent many thousands of dollars developing new ones and improving older versions.

The demand for such engines came from a segment of our hobby not normally associated with large growth or development impact—sport modelers. This sector has traditionally been in the shadow of modeling circles. Having no trophies on the mantle or credits of a major contest victory, sport modelers are nonetheless the real backbone of this hobby. They might never see their name in a modeling publication or receive high acclaim from their modeling friends, but they don't really need that. They receive their satisfaction simply by expression and participation in the hobby. A major win at a local fun-fly would be nice, but is not a necessary achievement for them. They're simply having too much fun to worry about it. Their world is what the true modeling world is all about—having fun—and the way they do this is by keeping that aspect in view.

The .40 cubic inch model airplane engine may not be impressive in size, sound, or dollar value, but it holds the key to a formula for success, not only for the modeler but for manufacturers that support this engine by way of kits, radios, and accessories, and the sport modeler turns the key. Who said the "little guy" never wins? Well, in this case the sport modeler has won it all. When I wrote the "Big Gun Shoot-Out" for .60-size engines in the April 1986 issue of *M.A.N.*, I said that there were no losers. Naturally in a report such as this we all want to know which one is "the best." This report is not to determine which engine puts out the most power (although that is a natural by-product of the tests and the results speak for themselves), it is to relay some information about most .40 engines that are currently available. Unfortunately, not all engines are listed. Strange as it may seem, some manufacturers still don't believe in this kind of test. Be that as it may, you can be assured that even if an engine is not included in this report, it doesn't mean that the engine is no good or not worth testing. It simply means that for the purposes of this article the engine was not available and will have to stand on its own.

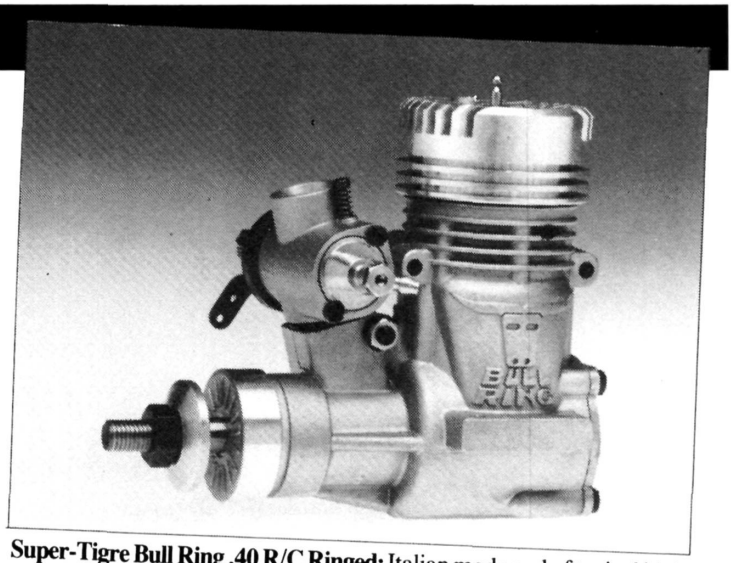
The conditions for these tests were identical for all engines: a temperature of 45°, an atmospheric pressure of 29.92 hg, and a relative humidity of 85%. The fuel was a mixture of 5% nitro, combined synthetic and natural lubricants, and methanol—the average sport fuel formula. Three different

tachometers were used to compare figures, which were then averaged, and as you can see in the test figures, several sizes of propellers were used: Top Flite 9x6 and 9x7 and Zinger 10x6 and 11x6.

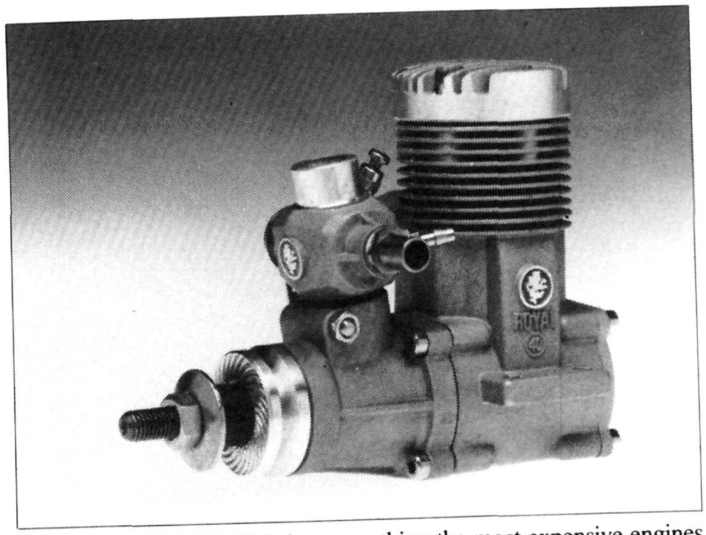
It should also be noted that every engine tested was an off-the-shelf purchase and new in the box just as it would be if you had ordered it by mail or got it at your local hobby shop.

As with any new engine, I took several pre-run steps, namely checking the inside of the engine for debris that either could have been overlooked at the factory or inadvertently swallowed while sitting in a display case. I pulled the head and backplate to do this and also checked to see that the engine was free of any unusual friction or binding. I also pulled the carburetor to check the seal and freedom from debris below the throttle barrel. I do these procedures with any new engine. If you're not familiar with ABC engines (aluminum piston, brass sleeve, chrome liner) you should know they are made to be tight, especially as the piston reaches the top of its stroke, so don't be alarmed if the piston sticks when you try to turn the crankshaft, which by the way, should never be done unless there is lubricant present in the engine. (This applies to any engine.) What did I find? Metal, metal, metal! In fact, if I had gone ahead and run these engines, four of them would have been ruined. I cannot overemphasize the importance of checking your engine before you run it. It could cost you an airplane and certainly an engine if you don't.

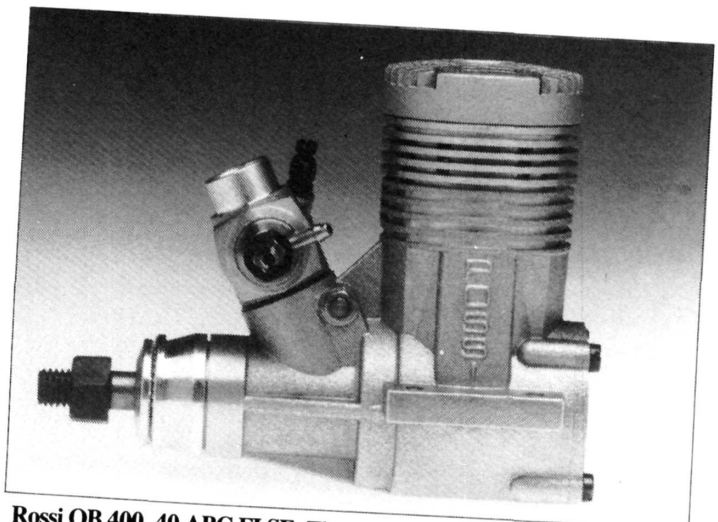
I gave each engine a break-in of one hour, consisting of 6 separate runs. The first was for 2 minutes, the second for 5, the third for 10, the fourth and fifth for 15 each, and the final for the remainder, during which I momentarily brought the engines to peak rpm and then backed them off. I did this by letting the engine run off peak and then pinching the fuel line momentarily, which let the engine surge. I have found that by breaking my engines in this way they perform well in the air and last a lot longer. During each run I monitor the crankcase for any unusual heat. The case should be somewhere between warm and hot, but not hot-hot. Between runs I check the screws on the head, the backplate, and the carburetor for loosening. This check also gives the engine a chance to cool down a bit. During the break-in the engine is undergoing a tremendous test, not only in function but in metal adjustment to new conditions. It has never before experienced the friction or heat now present, and it needs to adjust itself. That is why most engines will run stronger and last longer if you take proper care during this



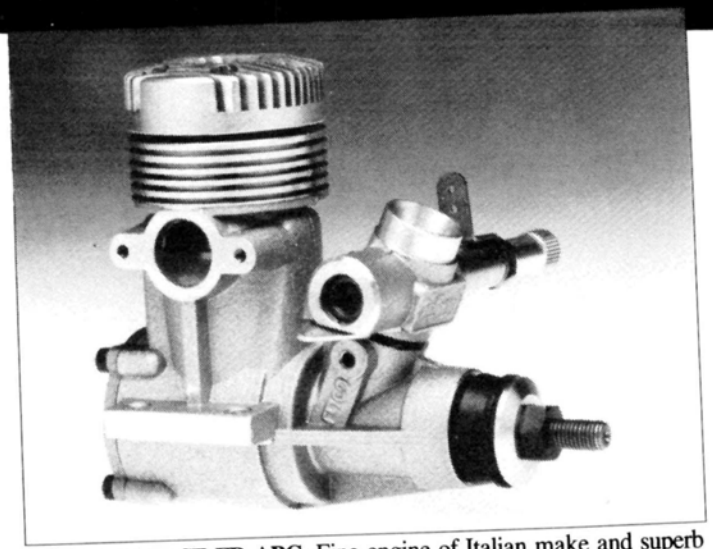
Super-Tigre Bull Ring .40 R/C Ringed: Italian made and of typical high quality. Easy to start and adjust, and showed no signs of sag. Came with new style muffler of large expansion and volume, and was very quiet.



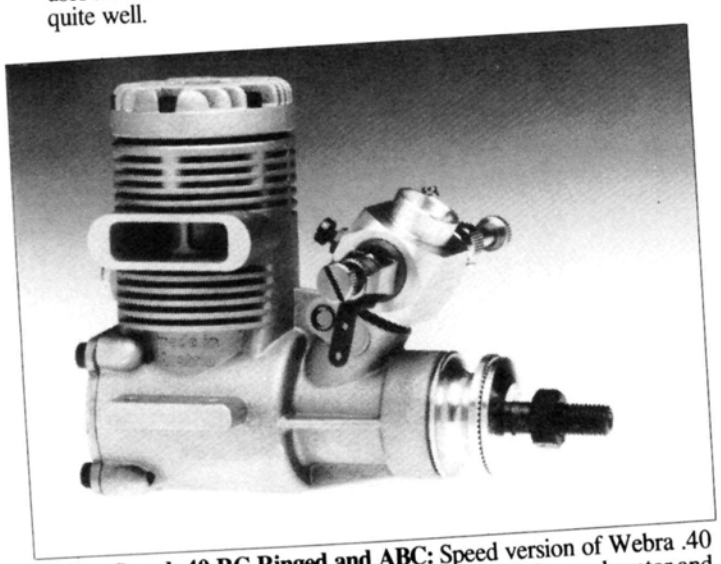
Royal .40 R/C ABC: This has everything the most expensive engines have: Schnuerle porting, ABC configuration, ball bearings, and advanced self-sealing carburetor. Engine runs well, power output was surprising for such an inexpensive engine. Almost had to be begged to stop, idle was so low.



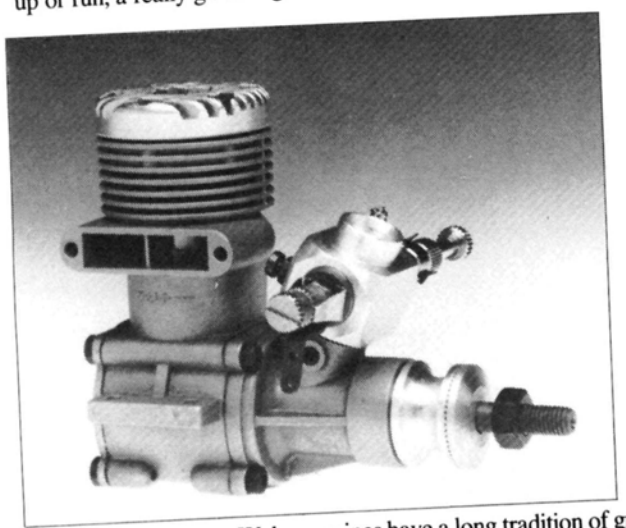
Rossi QB 400 .40 ABC FI SE: The most powerful of all the .40s tested, this engine follows tradition of excellent quality, super performance, and lasting durability. Handling qualities were nice and power and throttle response were good.



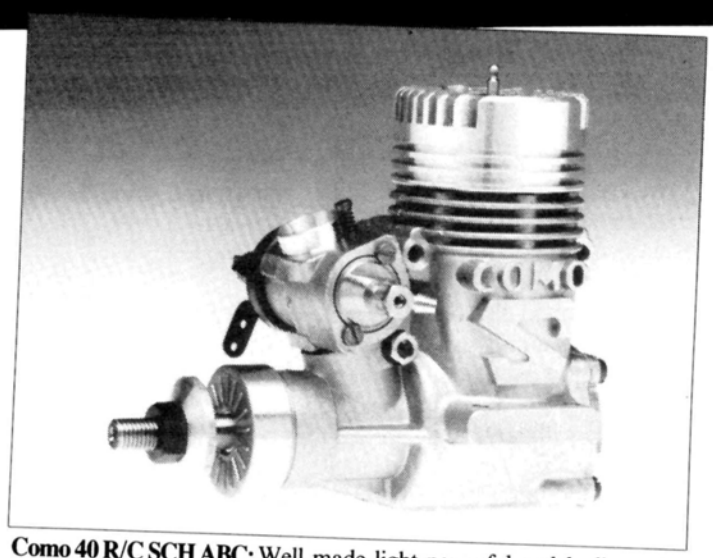
Picco P40 RC SE FR ABC: Fine engine of Italian make and superb quality. Very easy running and started up first flip every time. Throttle uses a slide barrel versus rotating one, and was easy to set. Held setting quite well.



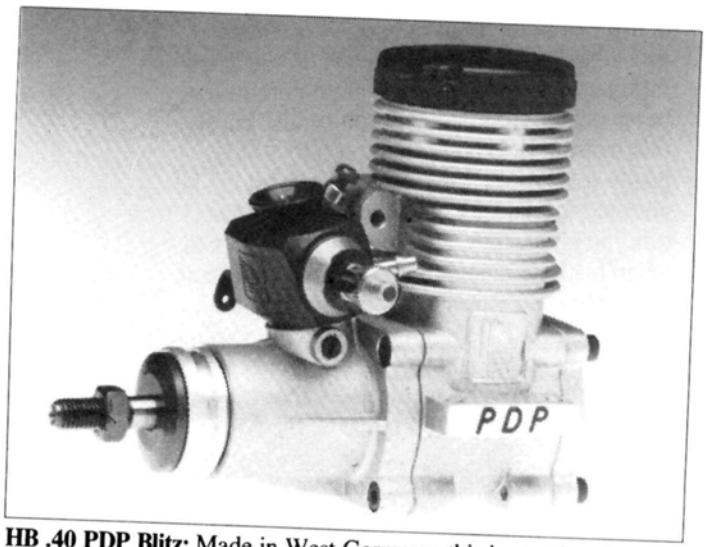
Webra Speed .40 RC Ringed and ABC: Speed version of Webra .40 line, a very powerful engine. Uses tried-and-true Webra carburetor and has great response from idle to full throttle. Engines used Schnuerle porting (Dykes ring and ABC are identical in appearance), has expansion style muffler and two ball bearings on crankshaft. Rod is bushed at both ends and case is attractively styled. Not at all tricky to set up or run, a really great engine.



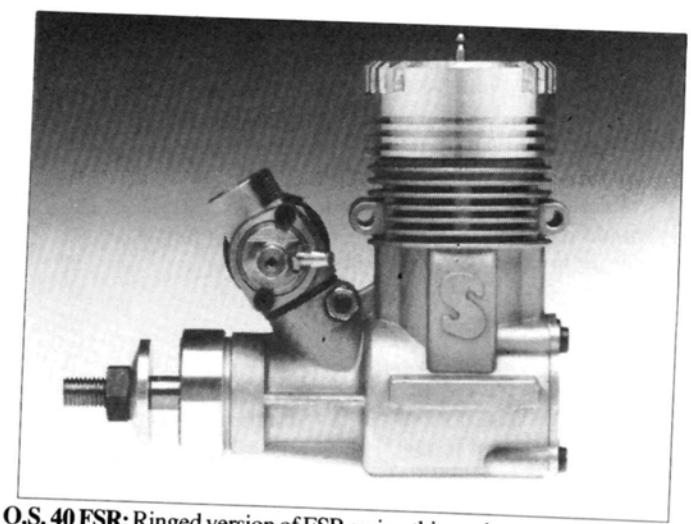
Webra .40 RC Silverline: Webra engines have a long tradition of great handling coupled with good performance. This engine is no exception. A fine piece of engineering that has ball bearings on the crankshaft and a ringed piston. Handling qualities were great and Webra carburetor still remains one of the best around.



Como 40 R/C SCH ABC: Well-made, light, powerful, and docile engine features a new carburetor that incorporates external seal to prevent air leaks. Running qualities were superb and large volume muffler absorbed much of engine noise.



HB .40 PDP Blitz: Made in West Germany, this is a real rocket in a sturdy case. Features baffled piston and uses loop-scavenged porting, which, coupled with Perry Porting (PDP), makes a real powerhouse. Engine also features Perry carburetor and large volume expansion muffler.



O.S. 40 FSR: Ringed version of FSR series, this engine was probably not unlike thousands modelers have enjoyed for so long. Great little engine with good power, easy carburetor adjustments, and smooth operating qualities. Uses ball bearings on crank.

PERFORMANCE CHART	RPM FIGURES FOR DIFFERENT SIZE PROPS			
ENGINE	9x6	9x7	10x6	11x6
COMO P40 RC SE FR ABC	14,500	13,800	13,800	10,800
HB 40 PDP BLITZ	16,200	16,000	15,000	13,800
K&B 40 FR	12,800	12,400	11,800	10,900
O.S. 40 FP	12,900	12,600	11,700	10,900
O.S. 40 FSR	14,500	13,600	13,600	10,900
O.S. 40 FSR ABC	14,700	13,900	13,900	10,800
ROSSI QB 40 ABC FI SE	16,600	16,200	15,200	13,700
PICCO P40 RC SE FR ABC	15,100	14,000	13,600	11,000
ST BULL RING 40	14,700	13,800	13,600	11,000
ROYAL 40 R/C ABC	14,500	13,500	13,600	10,800
WEBRA 40 RC SILVERLINE	13,100	12,600	12,000	11,100
WEBRA SPEED 40 RC	14,500	13,600	13,500	11,200
WEBRA SPEED 40 ABC	14,800	13,900	13,700	11,200
ST 40 ABC FI	14,900	14,000	13,900	11,200

critical period.

One note concerning the engines tested and the figures they represent. Naturally it would be unfair to compare the Rossi against the O.S. FP, or the K&B against the HB Blitz. They are entirely different breeds of cat that happen to be in the same displacement arena. Obviously a boost-ported ball bearing ABC engine is going to outperform an engine of lesser technological makeup. It's also going to be much more expensive. The bottom line is what engine will do the job for you, not what it costs or how beautiful it is. The race for dollars per cubic inch is really not a concern for the sport modeler anyway. ■

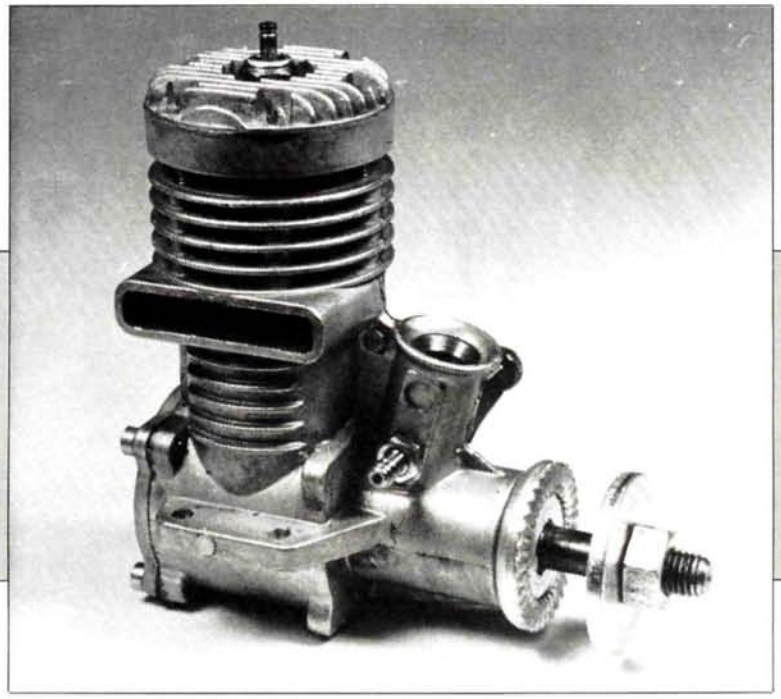
The Design & Development of the Two-Stroke .40

According to the people who sell them, the most popular type of two-stroke-cycle model engine is the "Forty"; i.e., the 0.40 cubic inch (or 6.5 cubic centimeter) displacement size.

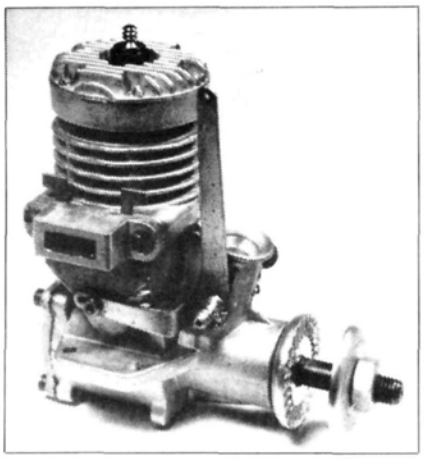
It is now just a quarter-century since the first .40 cu in. class motors appeared on the market, so we have reached a rather appropriate milestone at which to stop and take a look at how modern 40s have evolved from those early beginnings.

It is to control-line flying and to engine manufacturer Duke Fox, in particular, that we owe the introduction of the .40 size. Until 1960 the popular medium displacement glowplug engine groups were the .29, .35 and .45 sizes. The more powerful "29s" were aimed mainly at the C/L speed and team-racing fraternities, while the "35" (almost invariably a Fox Stunt 35) was the inevitable choice for C/L aerobatics. The .45 displacement, at the time, was being introduced primarily for a then fairly new development, namely, multi-channel radio-control pattern models.

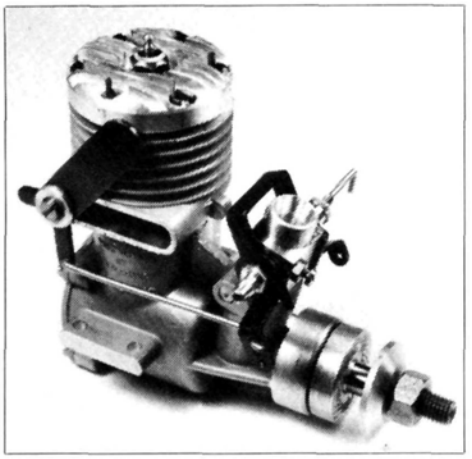
by PETER CHINN



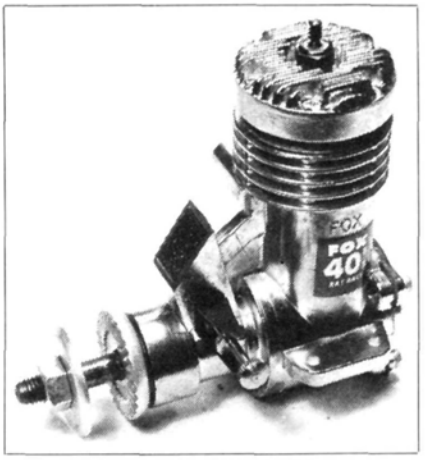
FOX 40 (1961)



FOX 40RC (1962)



SUPER-TIGRE G.21/40 (1962)



FOX 40BB (1963)

Enter the Rat-Race 40

An offshoot of C/L stunt, combat flying, had resulted in the evolution of a more powerful class of .35 size engine. Another development in the same area was C/L "rat-racing" but, here, rules were drawn up allowing engine displacements of up to .40 cu in. Duke Fox was the first manufacturer to take advantage of this situation by announcing, in 1961, a .40 size development of the original Fox Rocket 35 engine that had been introduced during the previous year.

Externally, this first Fox 40 closely resembled the Rocket 35. It was based on the same one-piece body casting and had the same cylinder head. Its larger displacement was the result of an increase in piston stroke, from 0.700 in. to 0.790 in., which, with the 0.800 in. cylinder bore, raised displacement from 0.352 cu in. to 0.397 cu in. In common with the 35, it had a ringless cast-iron piston running in a steel cylinder sleeve and the body casting contained a bronze bushed main bearing to support the crankshaft.

Collectors of old engines may care to note that, although it was never officially designated by the factory as a "Rocket" 40, this earliest Fox 40, based on the Rocket 35 main casting, actually carried the name "Fox Rocket" cast on the side of its bypass passage. 1962 models, however, appeared without the Rocket emblem. Hopefully, this explanation will end any arguments among engine buffs as to whether a Fox "Rocket 40" actually existed.

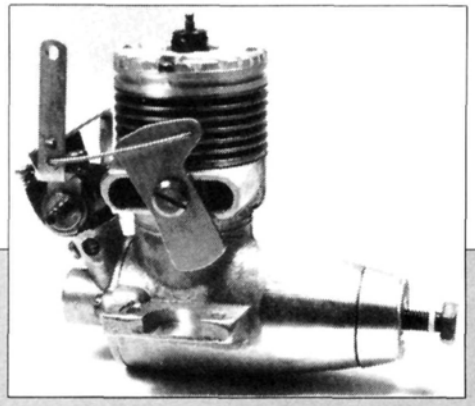
A throttle equipped version of the Fox 40—known simply as the Fox 40 R/C—also appeared early in 1962. Its throttle system combined part-rotational movement of a flattened spraybar (acting as a form of butterfly valve) in the air intake, with a vertically-sliding steel baffle in the exhaust stack. This worked, but the engine was not one of Duke's more successful designs and was withdrawn after only a short production run.

Super-Tigre G.21/40

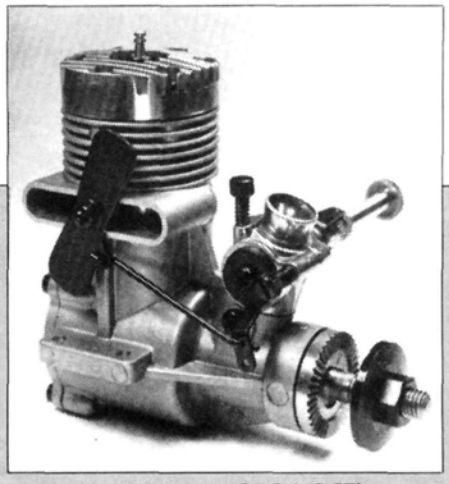
In 1962, the Italian Super-Tigre factory began making a .40 cu in. engine based on its then current G.21 model, which, over a period of some twenty years, appeared in a wide variety of guises, ranging from .29 to .46 cu in. displacement. The 1962 G.21/40 was offered as a rat-racing engine and as a throttle equipped R/C engine. It was made in both lapped (cast-iron) and ringed (aluminum) piston versions and, like all G.21s, had its crankshaft supported in two ball bearings.

The 1962 model G.21/40RC, tested for *M.A.N.* "Engine Review" series in that year, produced a power output of 0.55 bhp at 12,000 rpm on standard 5% nitro fuel and was rated as one of the "better" medium-sized R/C engines of its day.

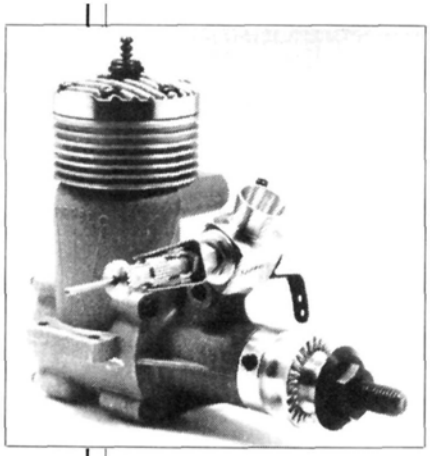
In 1963, the original Fox 40 rat-race engine was replaced by a new model called the 40BB which had its crankshaft supported in a single ball journal bearing, supplemented by a needle bearing at the front. This, like the 35X model, also new at the time, was distinguished by a large rectangular shaped air intake and both these motors were exceptionally good performers. The further improved 1964 "Golden" model 40BB rat-racing engine



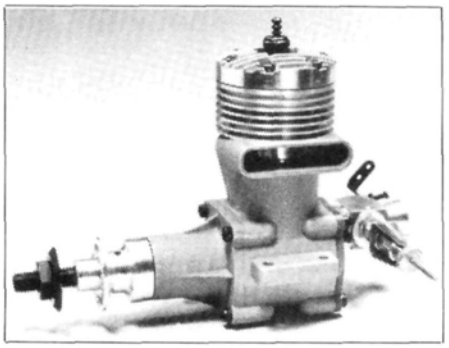
TONO 6.6 (1963)



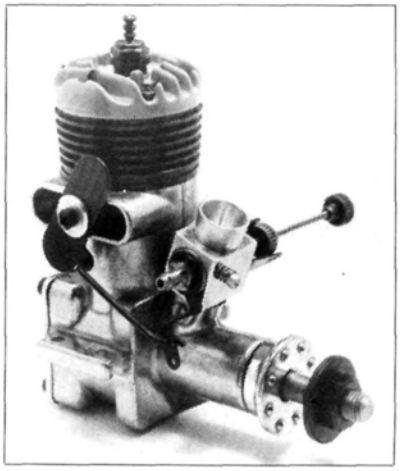
O.S. MAX-H.40RC (1965)



K&B TORPEDO 40 R/C "Series 66" (1966)



K&B TORPEDO 40 R/C "Series 67" (1967)



McCOY "Blue Head" 40 R/C (1966)

achieved the highest power/weight ratio of any engine tested for *M.A.N.* up to that time when, on 30 percent nitromethane racing fuel, it returned 0.98 bhp at 16,000 rpm for an engine weight of only 8.2 oz.

TONO 6.6

Oddly enough, during the first three or four years of .40 size engine production, only one other make appeared and that was the TONO 6.6, produced in small numbers in Czechoslovakia and rarely seen in the West. Quite a bit different from the Fox and Super-Tigre, this twin ball bearing R/C engine had the carburetor at the back with induction through a rear rotary drum valve.

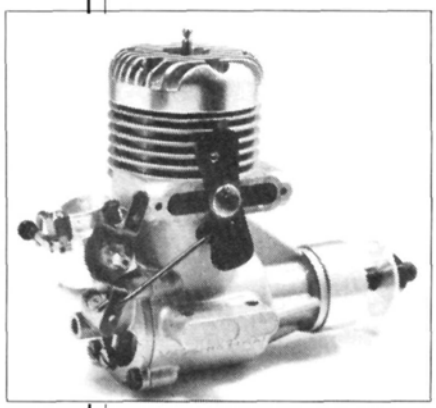
A shot in the arm from the NMPRA

In the mid-sixties, interest in the .40 size engine received a boost when, following pioneer work by Jerry Nelson, the National Miniature Pylon Racing Association was formed, to promote radio-controlled Goodyear type circuit racing.

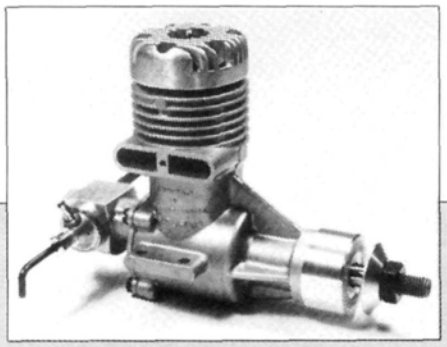
The NMPRA rules called for the use of unmodified series-production engines of not more than .40 cu in. displacement, with standard throttle-type carburetors that would be effective enough to allow a taxying speed below that of a fast walk. These rules, originally intended to attract a large following among ordinary "Sunday fliers," were subsequently relaxed (mistakenly, some would say) and, as a result, highly modified racing engines with wide-open air intakes, instead of restrictive carburetors, began to take over the event. However, in 1963, the incentive for manufacturers to produce engines to meet the NMPRA rules was clear.

O.S. Max-H.40 R/C

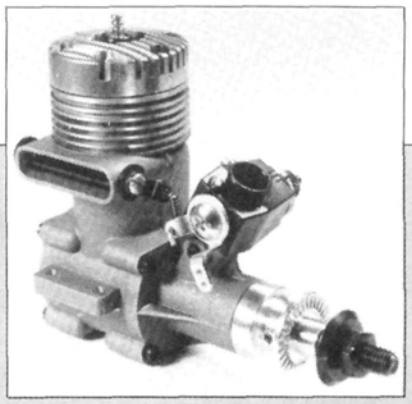
The Japanese O.S. company had, during 1963-64, been working on a new range of engines to be known as the Max-H series and, when these appeared, early in 1965, they were seen to include a Max-H.40RC model which, although designed for general R/C use, appeared to fit



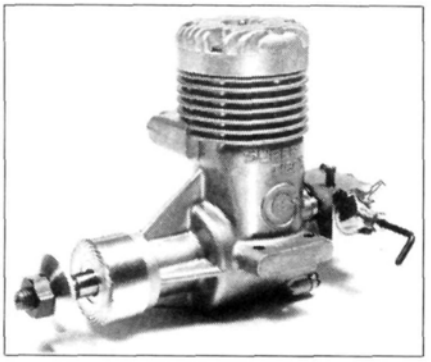
SUPER-TIGRE G.40 (1966)



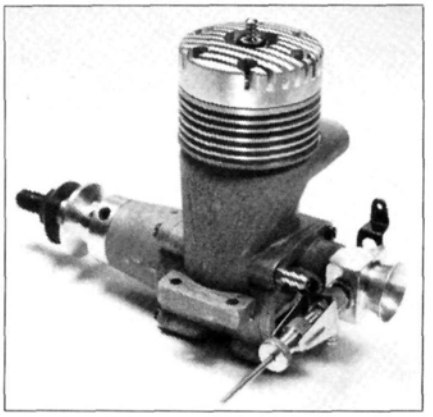
SUPER-TIGRE G.21/40RV (1968)



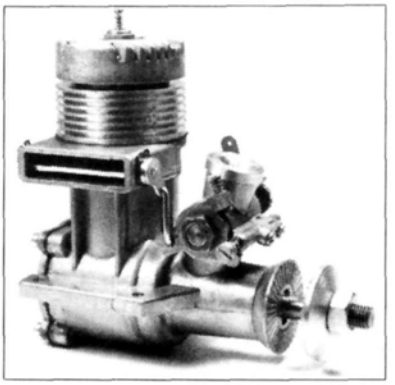
K&B TORPEDO 40F R/C "Series 70" (1970)



SUPER-TIGRE G.40-ABC (1970)



K&B TORPEDO 40R "Series 71" (1971)



FOX 40RC (1971)

NMPRA requirements to the letter. Tested for *M.A.N.* in the spring of 1965, the Max-H.40RC yielded lively performance and excellent throttle response. The engine became a favorite with Goodyear pylon racing enthusiasts on both sides of the Atlantic until the arrival of the Torpedo 40 "Series 66," manufactured by John Brodbeck's K&B Manufacturing Company of Downey, California.

The introduction of the Torpedo 40 was to mark the beginning of a period during which K&B was to enjoy immense success in American pylon racing. Prior to the 40 "Series 66," K&B had manufactured the "Series 61" and "Series 64" ranges of control-line and free-flight contest engines. These included .15 and .29 size rear rotary-valve racing engines, plus a front rotary-valve .35 cu in. model. All featured twin ball bearing crankshafts.

The Torpedo 35 formed the basis for the Torpedo 40 "Series 66." The enlargement in displacement, from the 35's 0.353 cu in., to the 40's 0.399 cu in., was effected by an increase in cylinder bore from 0.790 in. to 0.840 in. and this was accompanied by a change from a lapped cast-iron piston to a Dykes-ringed aluminum one—the first time that a Dykes type piston ring had been used in a volume-produced model engine. Also modified was the internal shape of the bypass passage, which was widened at the top to aid breathing at high rpm. The carburetor was a simple barrel-throttle type with no means of adjusting the idling mixture, so idling abilities were a bit marginal but power was good, with, on test, an output on mild (5% nitro) fuel of 0.75 bhp at 14,000 rpm. The C/L rat-racing version of the 40 "Series 66," tested a few months later on K&B Supersonic-1000 fuel and with an open intake and pressurized fuel feed, returned over 1.0 bhp at nearly 16,000 rpm.

The first "Series 66" engines came off the production line in January 1966. In June of the same year, fifty prototypes of a rear disc valve version were assembled and two of these placed first and second in the U.S. Nationals Open Rat-Race event. This engine, the first production models of which were released at the end of 1966, became the Torpedo 40RR "Series 67." Its companion R/C model continued K&B's winning ways by becoming even more successful in pylon racing during 1967-68.

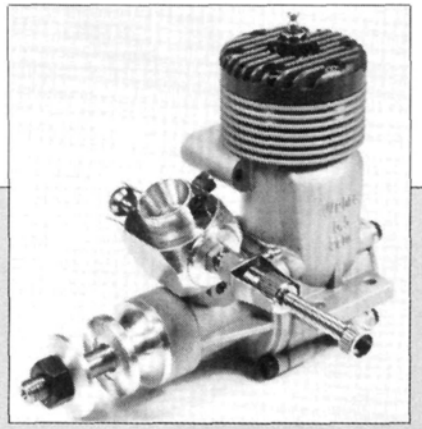
Further development of the "Series 66" and "Series 67" engines was seen in 1969, in the shape of the "Series 69" models which included both front and rear rotary valve versions. External appearances were little changed but modifications to improve breathing resulted in still more power. Our tests (*M.A.N.* November 1969) of the rear valve models yielded 1.18 bhp at 17,200 rpm on 30% nitro fuel for the pylon-racing motor and 1.25 bhp at 18,000 on 50% nitro for the rat-racing engine.

1970 models of the Torpedo 40 were identified externally by new bar stock heads. The rear rotary valve pylon racing engine had a squish type head and a further modified venturi intake increasing choke area to 50 sq. mm. A change in the "Series 70" line-up also saw the introduction of a standard 40 R/C front valve model intended for more general R/C flying. It had a Perry carburetor with a 21.5 sq. mm. choke area.

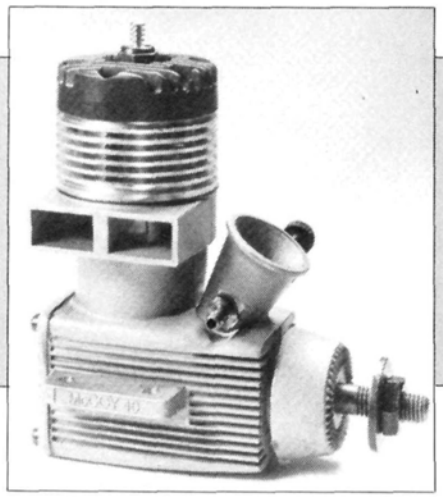
The final development of the highly successful Torpedo 40 line came with the "Series 71" engines, the disc-valve pylon racing version producing, on test, over 1.4 bhp at 19,000 rpm on 50% nitromethane fuel in our tests.

New FAI PR Rules

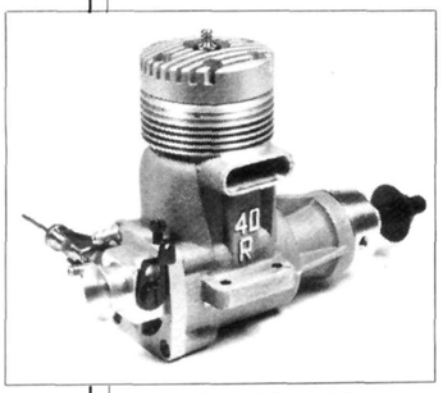
Although the K&B 40s were the "winningest" pylon racing engines of their



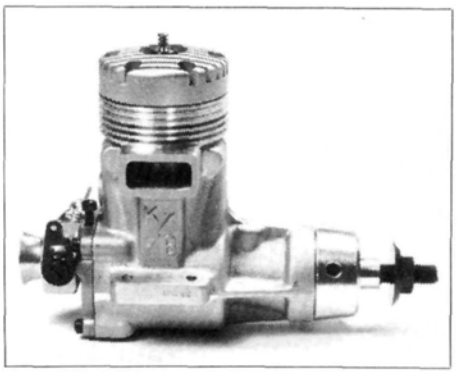
WEBRA 40 R/C (1971)



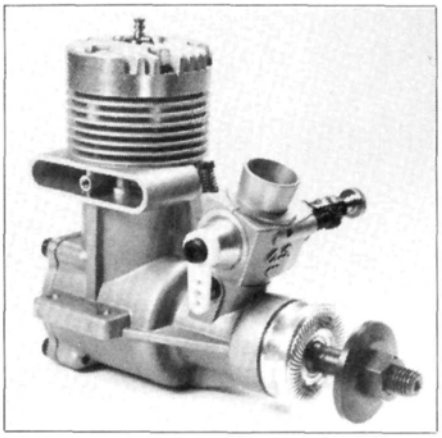
McCOY 40 "Series 21" (1971)



K&B 40R (1972)



K&B 40S (1973)



O.S. MAX-40 R/C (1973)

time, their later successes were mostly confined to the U.S. Part of the reason for this was the separation of .40 class pylon racing into two different categories. The elevation of pylon racing to World Championship status, by the FAI, was accompanied by a set of new international pylon-racing rules. These rules required a larger aircraft and restricted potential engine performance by barring the use of nitromethane. As with the FAI World Championship C/L speed class, only "FAI" fuel (a straight 80/20 mixture of methanol and lubricant) was allowed. The K&Bs, on the other hand, gave of their best only when operating on the high nitromethane fuels for which they had been designed and which continued to be permitted in the U.S. under NMPRA Goodyear (now renamed "Formula One") rules.

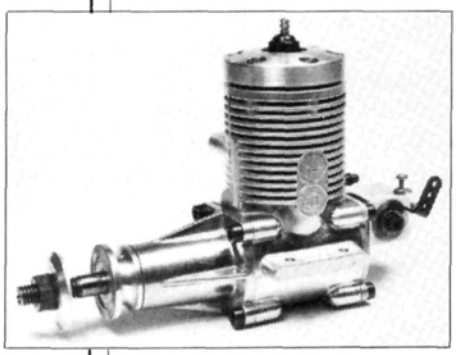
Two other makes were not challenging K&B supremacy; the Italian Super-Tigre G.40-ABC and the Austrian Hirtenberger HP 40R-PR. The Super-Tigre was a development of the original G.40 model of 1966 (which had not been overly impressive in this earlier form) and its pylon-racing achievements were mostly gained in the U.S. and as a result of the attentions of American tuning specialists, such as George Aldrich. HP 40R-PR successes, on the other hand, were mostly in European FAI class racing.

The HP was actually designed as far back as 1967 and was first seen in prototype form in 1968, but underwent a protracted period of development, including outside evaluation via a pre-production batch in 1970, before being put into regular production in 1971.

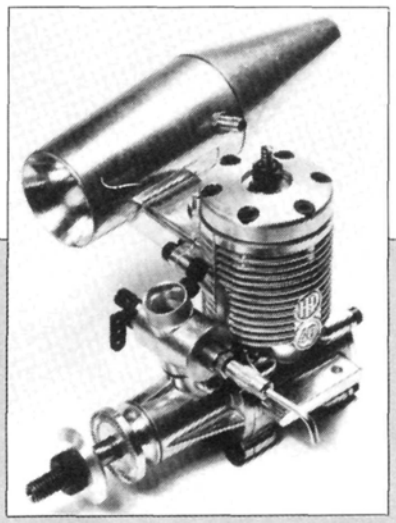
Schnuerle scavenging

A feature of all Hirtenberger engines, beginning with the limited production Paul Bugl designed HP 15 speed and team racing engines of 1965-66 and the subsequent HP 61 models, was their use of Schnuerle scavenging. The HP 40 was, in fact, the first production 40 to utilize this type of cylinder porting.

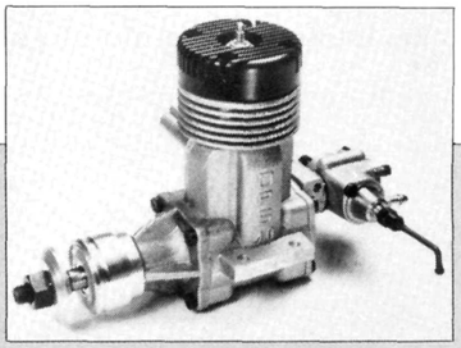
Actually, Schnuerle scavenging was far from new even at that time. In its original form, it had been invented in



HIRTENBERGER HP 40R-PR (1973)



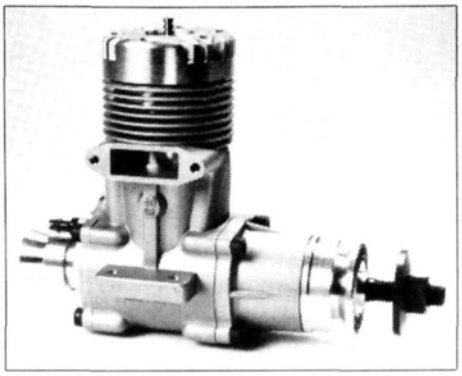
HIRTENBERGER HP 40F (1973)



OPS 40SLP-RCA (1973)

OPS 40SLA-RCA (1973)

OPS 40SPP-PYL (1973)



O.S. MAX-40SR (1974)

Germany by Dr. E. Schnuerle in the mid nineteen-twenties. Over the years, many different porting systems have been used for two-cycle engines, both model and full-size, but virtually all the production .40 size model engines prior to the HP had simple crossflow scavenging. In this, the transfer or bypass port is placed diametrically opposite the exhaust port and a baffle is usually incorporated in the piston head to deflect incoming gas upward and away from the exhaust port. Many sport type engines still have crossflow scavenging which, incidentally, used to be classified, with certain other arrangements, under the general heading of loop-scavenging, although gas flow through the cylinder is more in the shape of an inverted "U" than a complete loop. When some full-size two-cycle engine manufacturers began referring to their new Schnuerle type engines as loop-scavenged, a somewhat confusing situation arose which, by tacit consent, has since been resolved by reclassifying engines with diametrically opposed bypass and exhaust ports as crossflow scavenged.

In the original Schnuerle system, the incoming fuel/air charge entered the cylinder through ports located each side of the exhaust port but angled to direct gas flow across a deflectorless piston head toward the opposite side of the cylinder. A later modification was the adoption of a third bypass port (sometimes referred to as a boost port) diametrically opposite the exhaust and inclined upwards to assist in sweeping the mixture up into the combustion chamber. This, in various forms, is the type of Schnuerle porting that is now commonly used in most modern model two-cycle engines.

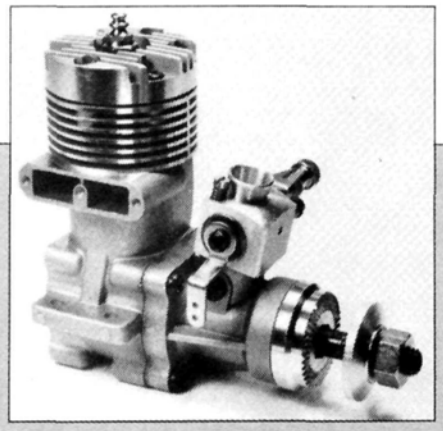
K&B 40-R and 40-S

Well before the time that the HP 40R-PR reached production status, it had become apparent that the crossflow scavenged Torpedo 40 engines had just about reached the limit of their development. A new design, designated K&B 40-R, with Schnuerle scavenging and a hefty one-piece body casting, was laid down. In the spring of 1972, a pilot run batch of one hundred and two K&B 40-R "homologation specials" were built in order to qualify the new engine for contest purposes. Within days of their release, these began setting new standards in Formula 1, starting with a 1, 2, 3, 4 placing "first time out."

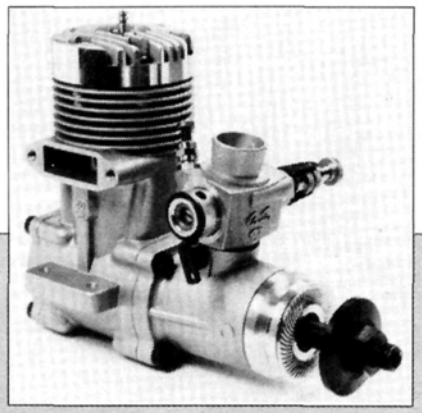
1973 saw the release of the production version of the K&B 40-R, now redesignated 40-S. This differed slightly in external appearance (largely as the result of a new permanent mold body casting, in place of the original sand cast case) but internal changes were relatively minor. On test, our stock engine, running on K&B Speed fuel, produced nearly 1.7 bhp at around 20,500 rpm—the best ever, to that date, for a .40 cu in. motor.

Sport 40 Developments

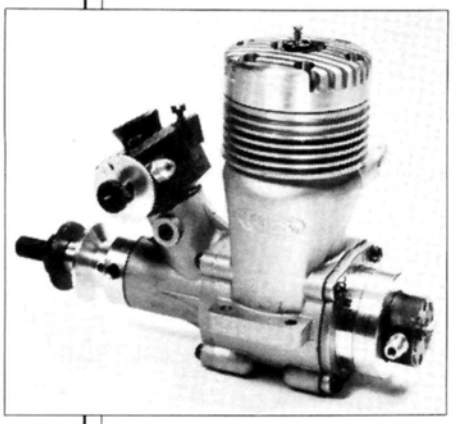
While pylon racing engines had been developing during the late sixties and early seventies, less specialized types of .40 cu in. power unit had also been appearing. By now, the market for alternative 40 size motors had swung in a new direction. The demand for C/L rat-racing engines had diminished and a much bigger market for throttle-equipped front rotary-valve motors was opening up. Such engines were in demand for R/C trainers and for the many medium sized pattern and sport type models that the



ENYA 40-TV (1974)

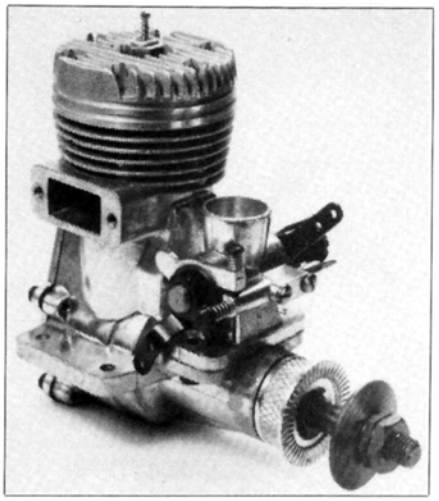


O.S. MAX 40FSR (1975)



K&B 40 R/C "Series 75" w/Pump (1975)

K&B SR-II 6.5cc (1975)



FOX 40RC (1975)

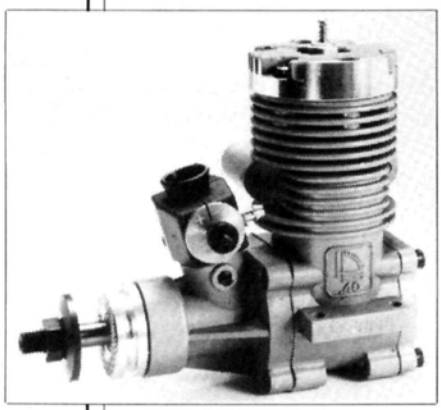
average Sunday flier found more convenient and less expensive than the larger, more sophisticated, .60 powered contest-type aircraft.

Some very low priced McCoy engines were marketed during the mid to late sixties by the Testor Corporation. Bearing little resemblance to Dick McCoy's famous McCoy Red-Head twin ball-bearing, rear disc valve racing engines fondly recalled by dedicated speed enthusiasts of the forties and fifties, these budget-priced McCoys were plain-bearing shaft-valve motors ranging from 0.19 cu in. to 0.40 cu in. and included both standard and R/C versions. Some of these engines (particularly the ones with sintered-iron pistons) tended to be somewhat lacking in compression from new, which made starting difficult. The trick here (for the benefit of anyone who might happen to have an old McCoy kicking around that has this fault) was to squirt a liberal dose of castor-oil through the exhaust port so as to improve piston seal. The "Series 21" engines made in the seventies had ringed aluminum pistons and did not suffer from this problem.

More Fox 40s

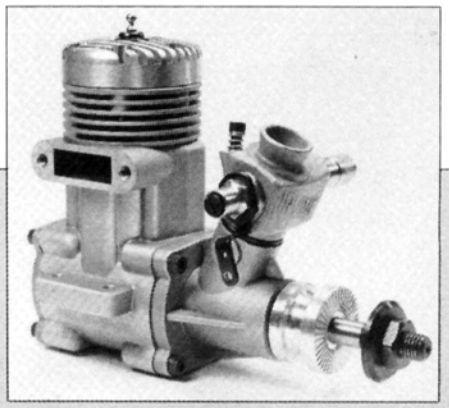
In 1971, the Fox company re-entered the throttle-equipped 40 field with an entirely new 40 R/C model of sturdy proportions which was featured in the March 1972 *M.A.N.* "Engine Review." This continued in production until 1974 when it was replaced by two new and much more powerful 1975 models of entirely fresh design. These (one with a bronze bushed main bearing and the other with twin ball bearings) featured Schnuerle scavenging and an unusual main casting in which a tall detachable backplate uncovered not only the crank chamber but the lower part of the cylinder liner as well. There were many differences between the plain bearing and ball bearing versions, including different port shapes, a ringed aluminum piston (instead of a lapped cast-iron one) and a bigger crankshaft in the case of the 40BB.

These engines were vastly more powerful than previous Fox 40 radio-control engines. Even the plain bearing engine,

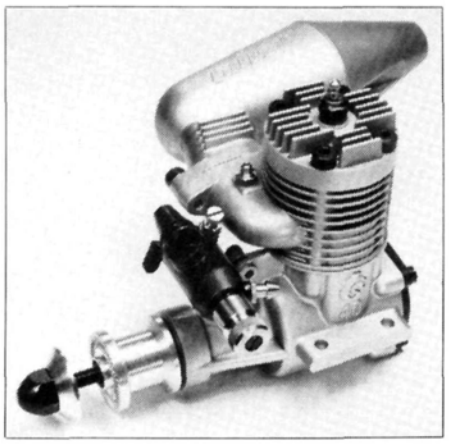


BERNHARDT HB-40 (1975)

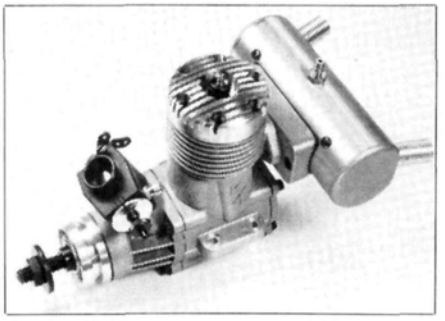
WEBRA SPEED 40 R/C (1975)



IRVINE SPORT-40 R/C Mk.I (1976)



BURFORD TAIPAN 40 (1976)



K&B 6.5FR R/C (1977)

ENYA 40X-TV (1978)

running on low-cost 5 percent nitro fuel, recorded a power output of 0.84 bhp at 15,600 rpm on test which was nearly 40 percent better than had been obtained for the 1972 model on 25 percent nitro.

In 1980, these two engines were upgraded, changes being externally visible in modified main castings, slightly smaller diameter machine-finished cooling fins, a new carburetor and a two-part cylinder-head. Some additional improvements were incorporated from January 1982 including a larger choke Fox Mk.10B carburetor, modified cylinder porting, a lighter piston and a modified combustion chamber shape to enable the engine to be operated on less costly low-nitro fuels.

These latter model Fox 40s—also available in enlarged bore .45 cu in. models—have all been fairly hefty engines, built for performance and durability, but some of the regular sport type R/C models intended for 35/40 size engines really need a lighter, more compact power unit. To meet these needs and also to provide modelers with a cheaper alternative, Fox began offering, in the summer of 1983, a new compact lightweight .40 cu in. R/C engine in the Fox "Series 5" range. This weighs only 9.8 oz compared with 13.0 oz for the larger engine.

Later K&B Developments

In 1975, the Torpedo name having been dropped, K&B introduced the K&B 40 R/C "Series 75" crossflow-scavenged, front rotary-valve engine for pattern flying. This engine was also made available in a more powerful version equipped with a larger Perry carburetor fueled via a Perry Pump/Regulator unit built into the crankcase backplate.

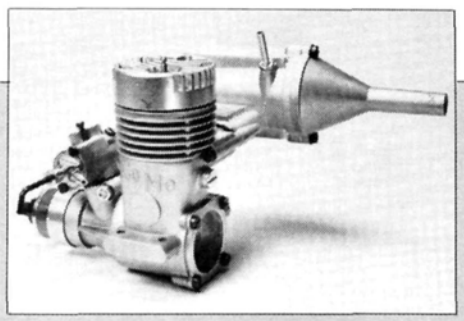
Also in 1975, K&B replaced the 40-S pylon racing engine with an entirely new model called the SR-II 6.5cc. With this, a switch was made, from K&B's much favored low-pressure Dykes-ringed piston, to an "ABC" setup—i.e., a ringless aluminum piston running in a chromed bore brass cylinder sleeve. Distinctively different, also, was the adoption of a metric designation (6.5cc), to identify the engine's displacement, instead of the Imperial (cubic inch) method of classification originated by American manufacturers and widely followed by others during the past forty years. K&B has given a metric identity to several more of its engines since that time.

With the SR-II, the factory once again had a pylon-racing success on its hands. Supplied completed with a minipipe, as approved for American Formula One use, the SR-II was rated by the factory at 2.4 bhp on high nitro fuel.

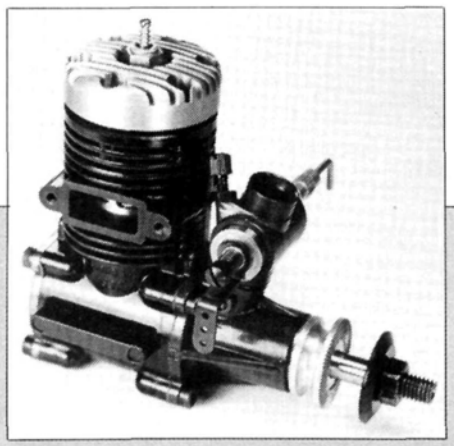
For those anxious to enjoy K&B levels of performance in a .40 cu in. pattern engine, the factory introduced, in 1977, a front rotary-valve conversion of the SR-II called the 6.5FR R/C. It was another powerhouse, developing a gross output (i.e., less muffler) of 1.40 bhp at an even 20,000 rpm in our tests. The engine came complete with a transverse cylindrical expansion chamber muffler that bolted to the rear exhaust stub.

Later O.S. Developments

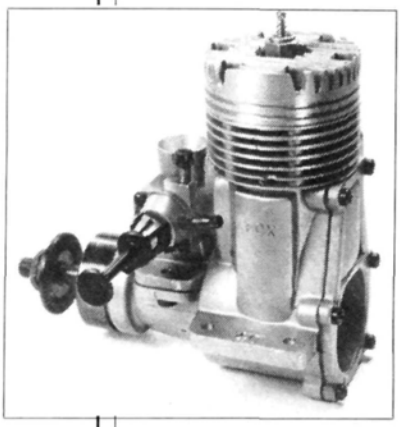
Although early Goodyear racing successes with the 1965 Max-H.40RC were overshadowed, within a year or so, by the K&B "Series 66," the O.S. company has produced several high-performance .40 class engines. In 1973, a pylon-racing contender appeared in the shape of the rear rotary drum valve, Schnuerle-scavenged Max-40SR. Improved in 1974, this had a performance compar-



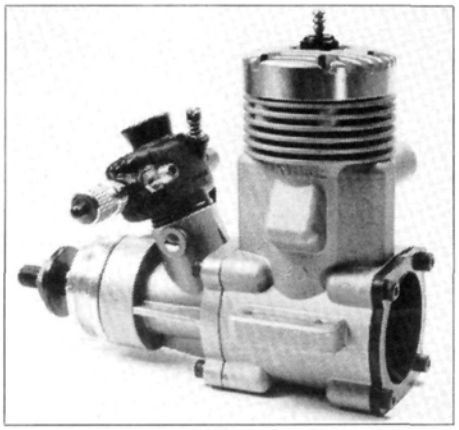
COMO 40 R/C (1979)



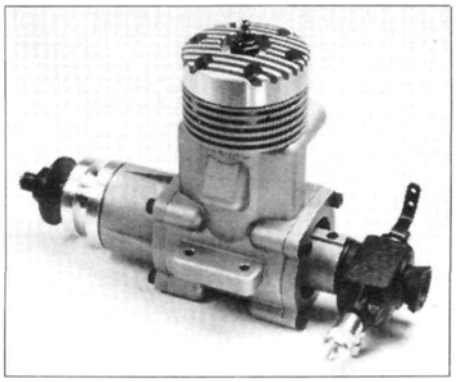
HIRTENBERGER HP 40F "Gold Cup" (1979)



FOX 40BBRC (1980)



IRVINE SPORT-40 R/C Mk.II (1980)



IRVINE 40 (RI-SE) (1980)

able (1.65 bhp at around 20,500 rpm on test) with that of the contemporary K&B 40-S and achieved some racing successes in its native Japan and elsewhere.

In 1975, the 40SR main casting was combined with new front and back ends, plus modified porting and a new head, to produce the Max-40FSR. This very popular front rotary-valve R/C pattern type engine has remained in production, with just minor modifications, ever since.

Also currently available, there is the front rotary valve Max-40VF-ABC for those who prefer a rear exhaust layout. It is rated, by the factory, at 1.25 bhp at 16,000 rpm. Again with a rear exhaust, but with rear rotary disc valve induction, is the Max-40VR-P racing engine, having a nominal output of 1.8 bhp at 23,000 rpm. All these engines are, of course, of the twin ball bearing type.

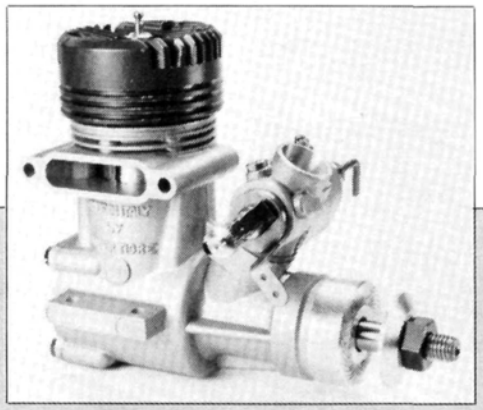
For many years, the biggest selling O.S. .40 size engine was the Max-40 R/C, a twin ball-bearing crossflow-scavenged engine first made in 1973. After twelve years' production, it was replaced by the current Max-40FP which has Schnuerle scavenging but uses a bronze-bushed (rather than ball journal) main bearing to bring the engine within the reach of those who need to budget.

OPS "Project 40"

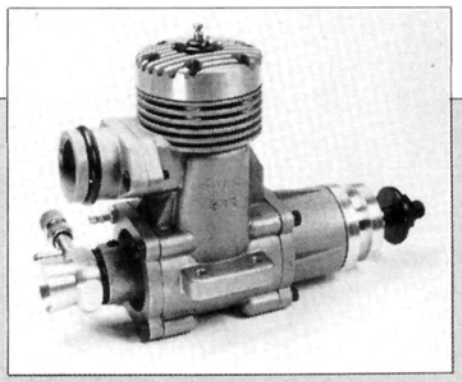
OPS engines are made at Monza in northern Italy and the first OPS to be marketed was an interesting Zimmermann-valved racing 60 in 1968. OPS has enjoyed many international successes with this class of engine over the years but is, perhaps, better known, these days, for its prominence in the world of model car racing where OPS 3.5cc engines have posted more wins than any other make. OPS has also had many successes in pylon racing in Europe.

It was in January 1973 that OPS entered the 40 field, with the announcement of its "Project 40." This consisted of two crankcase/cylinder-block units (one side exhaust and one rear-exhaust) two ABC piston/cylinder-sleeve assemblies with different port timings, two crankshafts and two front and rear ends. These items, together with a cylinder-head, conrod, wristpin, intake venturi, R/C carburetor, tuned exhaust pipe and flywheel, were offered as the "Project 40 kit" from

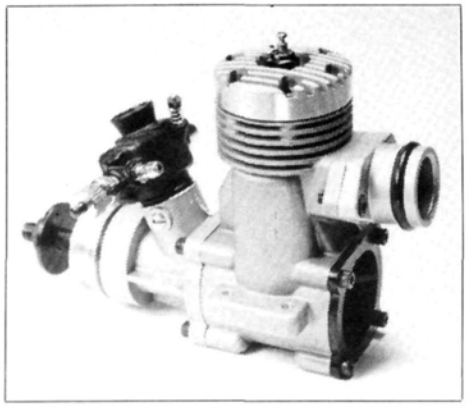
SUPER-TIGRE G.21/40FI (1980)



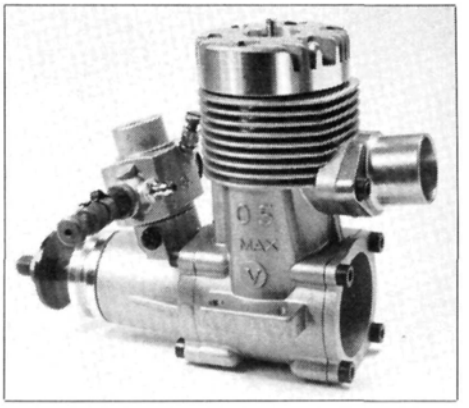
SUPER-TIGRE S.40 R/C (1980)



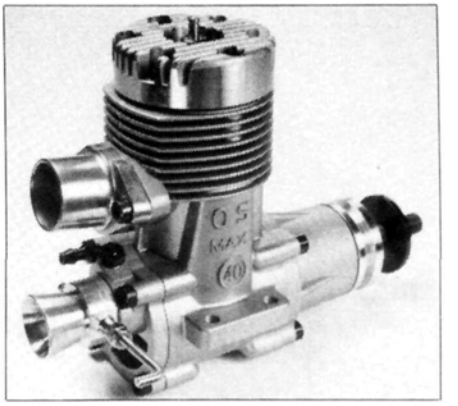
IRVINE 40R Speed (RI-RE) (1981)



IRVINE 40R R/C (FI-RE) (1981)



O.S. MAX-40VF-ABC (1981)



O.S. MAX-40VR-P (1981)

which no less than seventeen different engines could be assembled! These ranged from a standard side-exhaust front-intake engine, with or without throttle, to rear-exhaust, rear rotary-valve racing units for control-line speed, pylon racing or marine use. Alternatively, one could buy individual ready assembled engines. Obviously, the kit idea was meant to appeal to modelers with wide-ranging interests, but it did not catch on and, in subsequent years, OPS dropped it and concentrated on a rationalized range of 40s to cover the most popular applications.

All the OPS 40 engines are of the ABC type with Schnuerle scavenging and have twin ball bearing shafts. A standard 40-SLA (side exhaust, front intake) R/C engine tested for *M.A.N.* in 1974 produced a gross output of 0.90 bhp at nearly 17,000 rpm, which was marginally better than had been previously recorded, at that time, by a non-racing type 40 on 5 percent nitro fuel. Currently, factory claims for the OPS 40 range vary from 0.93 bhp at 14,500 rpm for the 40-SLA R/C model to 2.1 bhp at 26,000 rpm for the 40-SPP disc-valve, rear-exhaust piped racing engine.

Irvine

Now one of the largest model manufacturers and distributors in the United Kingdom, Irvine Engines was established in 1968 to import and distribute American and Continental European engines and other model products. Former speed flier Ron Irvine's ambition, however, was to manufacture his own engines and, following several years of experiment and development with prototypes, his first production motor, the Irvine Sport 40 went on sale in 1976.

The "Sport" handle notwithstanding, this was a twin ball-bearing Schnuerle-scavenged unit with power to match. Performance was further improved with the later "big shaft" Mk.II model featured in our March 1983 *M.A.N.* "Engine Review" test report. These are fast-turning engines, peaking, in open exhaust trim, at around 19,000 rpm, but Irvine now also offers a special tuned mini-pipe muffler (the Irvine "Super-Silencer" No. 3) that changes the shape of the torque curve and lowers the bhp peak to around 16,000 rpm without loss of power (1.16 bhp on test) to enable more efficient prop sizes to be used.

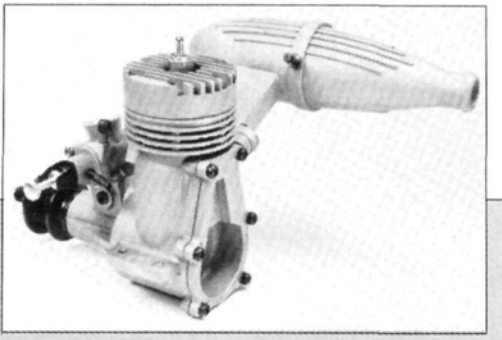
The Sport 40 is a shaft-valve side-exhaust engine, but the Irvine 40 range also includes both rear-induction side-exhaust, front-induction rear-exhaust and rear-induction rear-exhaust models.

Enya 40 and 40X

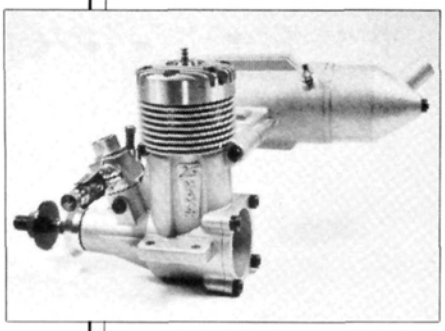
Although, over the previous twenty years, the Japanese Enya brothers had manufactured engines in practically every displacement group from .049 to .63 cu in., it was not until 1974 that they introduced their first 40. At that time, Enya motors were all of the crossflow-scavenged type but the new 40 had one feature that set a trend: it was the first .40 size engine to use a 15 mm diameter crankshaft in order to enlarge the rotary valve and gas passage for improved breathing. Most other manufacturers of .40 size engines followed this lead over the next three or four years.

In 1978, the Enya 40 was joined by a new Schnuerle scavenged engine, the 40X. Featured in the June 1978 *M.A.N.* test report, the throttle-equipped 40X-TV

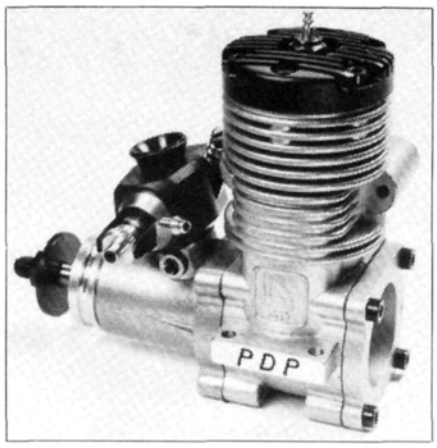
FOX 40BBRC (1982)



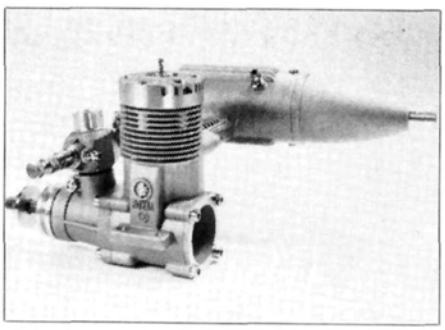
FOX 40 "Series 5" (1983)



O.S. MAX-40 FP (1985)



BERNHARDT HB-40PDP "BLITZ" (1983)



ROYAL 40 R/C (1984)

model proved to be well up to expected levels of performance for a quality 40 R/C engine, nudging 1.0 bhp at just over 16,000 rpm in open exhaust form, with good torque at lower speeds for pulling big props. The engine was also noteworthy for its easy starting and docile handling qualities.

Both these engines are still in production and are just about to be joined by a new 40 model in the recently introduced lower-priced Enya Super-Sport range.

Webra 40 and Speed-40

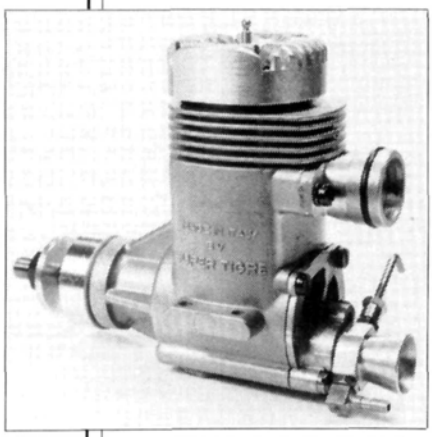
Early in 1970 it became known that the Berlin Webra factory was to manufacture a "40" version of its Blackhead 61 that had done so well in international pattern flying. It took another eighteen months to actually get the 40 on the market but the wait proved to be worthwhile. Our full test report on this engine appeared in the October 1971 issue of *M.A.N.*

The original 40 (still manufactured and sometimes called the Blackhead 40 although this is not the maker's name for it) is a crossflow engine. Webra's Speed-40 Schnuerle-scavenged engine (also still made) came four years later. A product of Webra's Austrian factory at Enzesfeld, the Speed 40 is a much heavier engine than the older model but makes up for this in extra power. Both 40s are twin ball-bearing shaft rotary-valve engines. Using 5 percent nitro fuel and an 8.0 mm Webra TN carburetor, our test model Speed-40 delivered a gross output of 1.10 bhp at 17,200 rpm.

HB 40 and 40-PDP

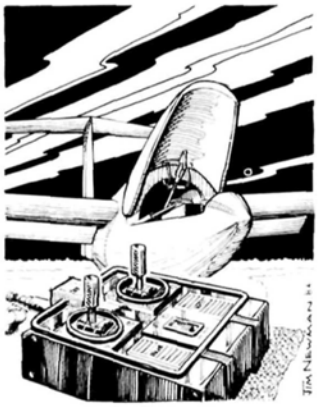
Made in Germany and strictly conventional, like the original Bernhardt HB 61 that preceded it, the first HB 40 appeared in 1975. Later, an uprated version, the 40-PDP, was marketed, the "PDP" indicating that its crossflow scavenging system had been modified to include the supplementary slots for the Perry Directional Porting system to improve torque and power. On test, using 5% nitro, the stock engine developed 0.67 bhp at 14,400 rpm with standard muffler fitted,

(Continued on page 105)



SUPER-TIGRE X.40 (1986)

ROSSI R40-FI (1986)



Soaring News

by JIM GRAY

RECENTLY, a young student of mine and I went over to the local high school athletic field for some test flying and some instruction. The grass on the entire field had been freshly mowed and it was like a sod farm...short, lush and green...still slightly moist and springy from the recent rain.

My student is Matthew Stoops, and in a way this article is about him because he's the one who built the sailplane we tested, a Poquito Primero designed and kitted by Buzz Waltz R/C Designs*. This little sailplane is one of three which provide Standard Class, Two-meter Class and Hand-launch Class sailplanes to suit every pocketbook and taste. As a matter of fact, I believe there's even an Unlimited Class machine available from Buzz. Poquito Primero, freely translated, means "Littlest One" and by stretching a point, we could call it a champion—which it certainly is.

The Buzz Waltz sailplanes are typical polyhedral-wing ships with turbulating spars behind the leading edge of the wing, broad chords, reasonable aspect ratios, and slim but adequate fuselages. The tail surfaces are large enough to provide excellent "free-flight" stability, meaning that you can relax a bit and let them fly themselves...giving control inputs once in a while for steering or correcting the flight path.

These quality building boards will last a very long time.

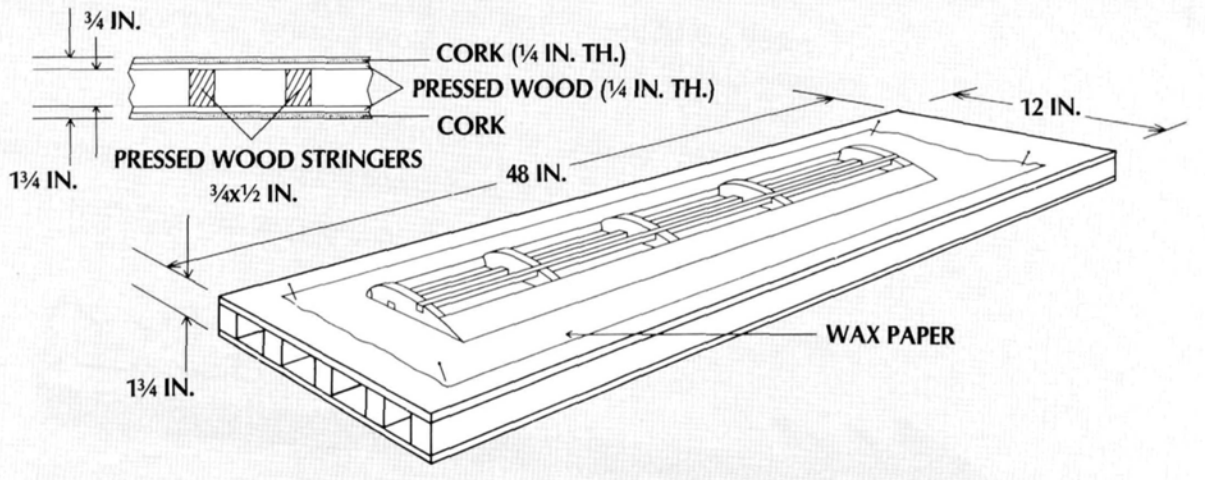
We can heartily recommend Poquit Primero as a *fun* sailplane, easy to build and easy to fly, with a surprisingly good overall performance. She turns on a dime and "telegraphs" the slightest lift by a change in attitude, yet is docile and forgiving in the hands of a beginner. What more can you ask of any sailplane?

Why didn't someone do it before? That's what I asked myself when I first saw Otto Bandmann's cork-covered building board. Otto and Rose Bandmann are the proprietors of Country Hobby Supply* up in Ontario. Otto is a builder and craftsman of great ability and ingenuity. I have seen his work in both the model aircraft and in the full-size aircraft, and can vouch for it without question. Here's an example. Otto's original sailplane design flies very well; it's fully competitive with most Standard Class machines of its type yet it uses some unconventional covering materials by today's standards—silkspan, for instance, as a wing and tail covering, put on with the old tried-and-true dope.

Back to the building board, which measures 12x48x1¾ inches and weighs a lot because it is constructed of pressed wood. The reason that it's as flat as humanly possible to make is that Otto used a built-up construction—hence the thickness. Two pieces of ¼-inch pressed wood form top and bottom, sandwiching the ¾-inch side pieces and lengthwise "stringers." The ends are "open" (see sketch). There are two ¼-inch pieces of cork acting as board "faces," one on each surface. Otto experimented with many designs before coming up with this one. The open construction allows free play of air on all surfaces, making sure that what

(Continued on page 76)

BANDMANN'S BUILDING BOARD



Graupner CHINOOK from Hobby Lobby

by CHARLES SPEAR

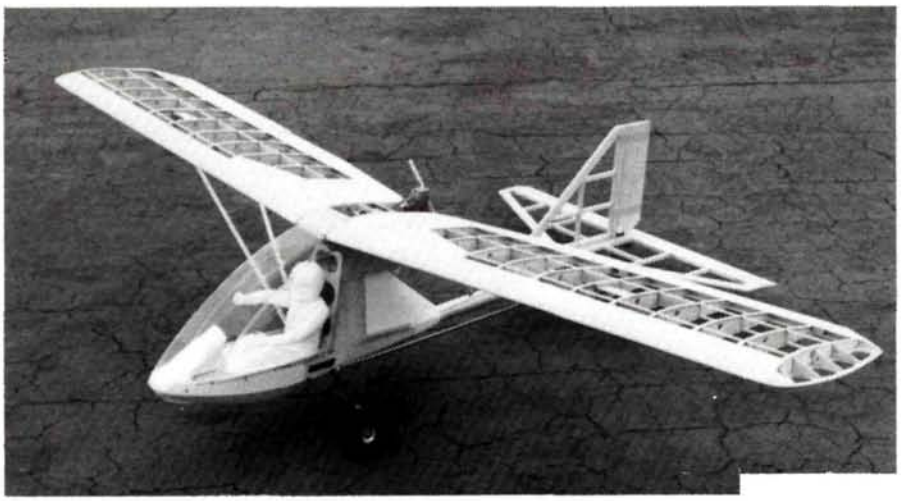
HOW MANY of our readers out there like to browse through the model magazines or hobby catalogs, dreaming about building a particular model if only the time could be found? I'm one of those dreamers. I took a visit to one of the trade shows to take me one step closer to that dream. Walking by the Hobby Lobby booth, my eye caught sight of the Hobby Lobby* Chinook fully assembled and hanging from the ceiling. One of the appealing features to me was that it was so different, a semi-scale R/C sport model of an ultralight, suitable for a .40 four-cycle engine. The full-scale Chinook is an enclosed cockpit ultralight, probably to keep the pilot from freezing, and is manufactured by Birdman of Canada.

THE KIT. The box was huge and with a four-color illustration of the completed model printed right on the cover. After removing the cover, I propped it up in a prominent place in my workshop. I thought it would give me the inspiration to build as beautiful a model as that shown on the cover of the box.

The first of four plan sheets showed the top and side views of the fuselage, fin, and rudder, along with about seven different cross-sectional views. Also shown on this plan sheet were the engine and radio installation. The second plan sheet showed both wing halves, wing struts and the horizontal stabilizer. The third plan sheet was a series of construction photographs with an excellent three-dimensional view in one corner of the sheet. The fourth sheet was a very complete set of step-by-step assembly instructions given in three languages, English included.

Type: *Scale*
Wingspan: *78 inches*
Wing Area: *914 square inches*
Weight: *6.6 pounds*
Channels: *4*
Engine: *.40 to .48 four-cycle*

A stand-off scale rendition of a Canadian ultralight.



Left: Extremely interesting and strong framework characterizes the Chinook airframe. Below: Pusher engine installation utilizes a well-used .40 four-stroke and 11x7 propeller. Bottom: Chinook's pilot is available as an optional item from Hobby Lobby.

Being an entirely built-up kit, the box was chock full of die-cut parts and strip wood. Outside of the balsa wing ribs, the rest of the die-cut parts were stamped and numbered on very light three-ply obechi wood. The die-cutting was sharp with no sign of crushing; but the die didn't go all the way through the wood. My trusty Dremel jigsaw did, however. Except for one or two pieces that were too soft for their intended purpose, the strip wood was of excellent quality. The formed parts, which included a belly pan and the rear fairing enclosures, were similar to our ABS plastic but of seemingly heavier thickness. The huge, three-piece canopy was molded from very heavy duty clear plastic. The balance of the parts in the kit included a formed landing gear, a tempered dual-aluminum tail boom and the aluminum wing struts; but no fittings.

After looking over the plans and reading the assembly instructions thoroughly, a set of fittings and wheels as well as the molded plastic pilot were ordered from Hobby Lobby. The model could be constructed without buying these parts as the average builder would

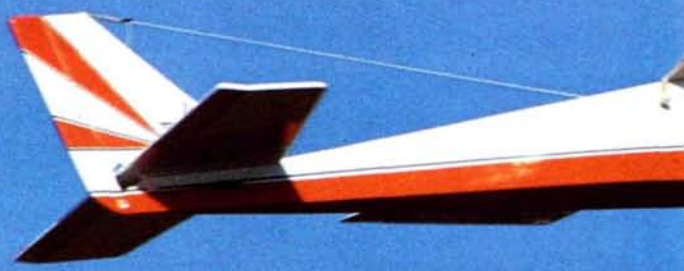
(Continued on page 115)

Far left: Curves and angles everywhere one looks on the Chinook. This is one airplane that will not bore the eyes. Left: Very simple tail surfaces evident here.

Type: Trainer
Wingspan: 60 inches
Wing Area: 675 square inches
Weight: 5 pounds
Channels: 3 to 4
Engine: .25 to .40 two-cycle
.30 to .48 four-cycle

PT-40

☆ from GREAT PLANES



A trainer that builds as easily as it flies.

by RON FARKAS

EVERY YEAR an assortment of new trainers reaches the market from various manufacturers. Some are quite ordinary and simply give the modeler one more choice in a long list of available kits that are not particularly outstanding. Some are a hybrid trainer and sport airplane design and are advertised to be multipurpose models, that is, you can learn to fly on them and then put in a larger engine, increase the control throws and go fly the AMA pattern. But most of these fall short of both goals. A few of the new kits are designed from the ground up to be primary trainers with which the rank beginner can master the basics of R/C flight and achieve both self-sufficiency end competence. These models make up a small group of airplanes that possess the right trainer properties and sometimes go on to

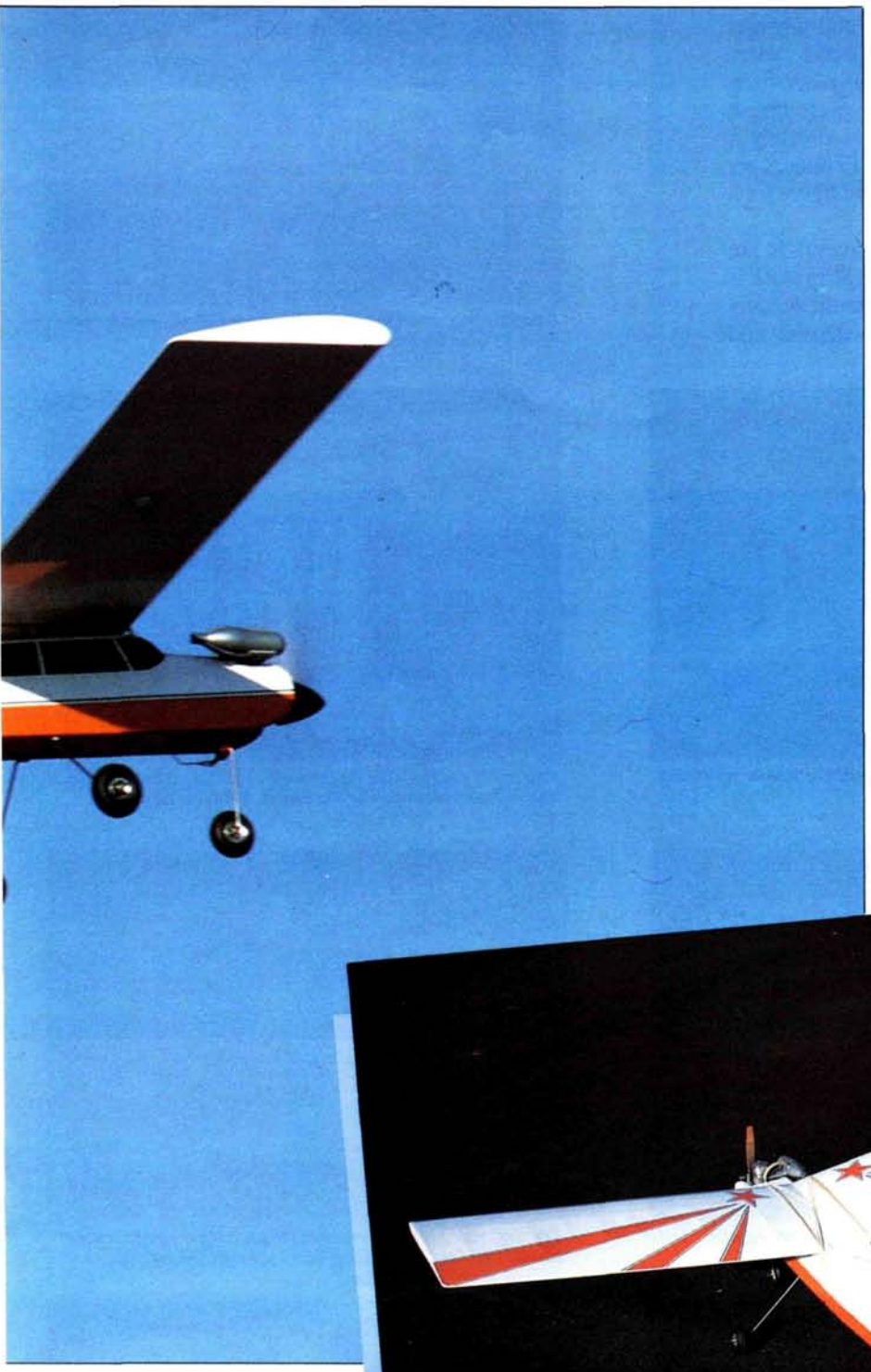
photos by RICH URAVITCH

PT-40 is powered by a K&B .40 but is suitable for engines .25 and up. The aircraft also flies well with .45 four-strokes.

become the standard by which others are judged. The Great Planes* PT-40 falls into this last group. The PT stands for perfect trainer and the 40 indicates the maximum intended engine size.

A manufacturer that is confident of a trainer design is apt to be pretty boastful in the advertising. The PT-40 ads claim that the model "is a breeze to build...won't let you lose control," and even "lands itself." Wow. That's a tall order for any plane; but my experience with the PT-40 indicates that it comes very close on all counts. The PT-40 can be built for either three- or four-channel operation. The three-channel version with rudder, elevator, and throttle as reviewed here is most likely to meet the above flying criteria for beginners who must learn to fly without the benefit of an instructor. The model can also be built with ailerons or converted later for intermediate- and advanced-level training.

The wingspan is 60 inches and the area 675 square inches. The wing uses an 11.5% thickness, flat-bottom airfoil with a very blunt leading edge. The fuselage is 45 inches long and the horizontal tail area is approximately 20% of the wing area. The three-

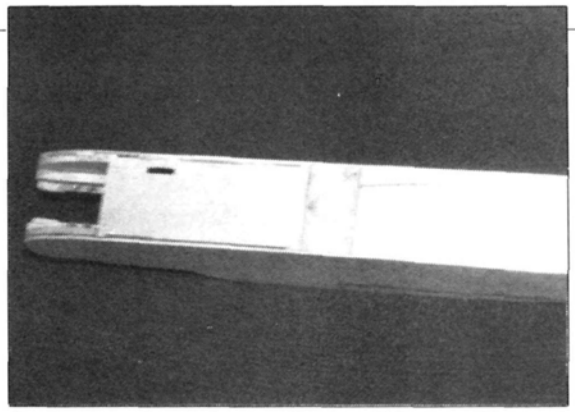


The force arrangement of the PT-40 is ideal for an aircraft intended to train novice pilots.

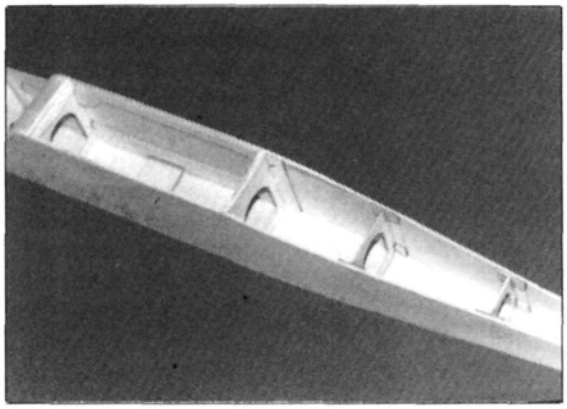
★ ★ ☆ ★

channel wing uses 8 inches total dihedral and the aileron-equipped wing uses 5 inches. Two-cycle engine requirements range from .25 to .40, with up to a .48 four-cycle engine capability. The weight is approximately 5 pounds with a wing loading of 17 ounces per square foot, which is a nice light figure for a trainer.

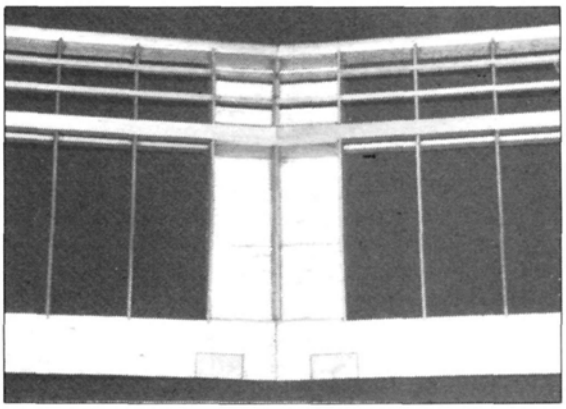
THE KIT. The basic kit materials are balsa wood and light plywood. Strip stock is both balsa and basswood. Both the leading and trailing edges are pre-shaped and



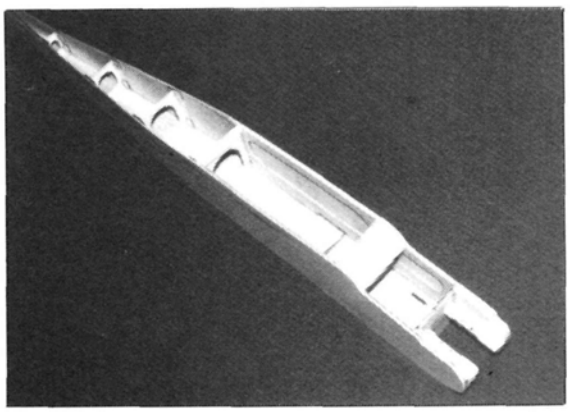
Landing gear is attached to a hardwood block, and forward fuselage base is covered with lite ply sheet.



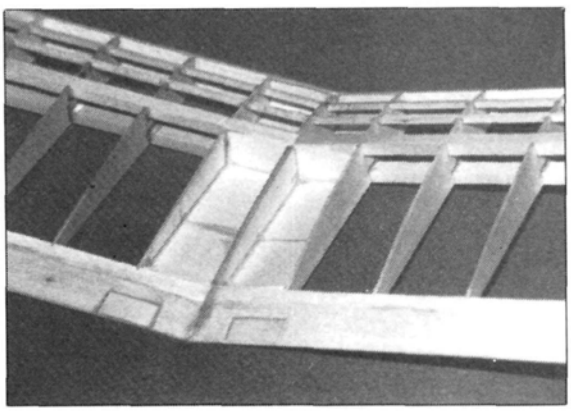
Formers, doublers, and sheet sides make a simple yet strong structure.



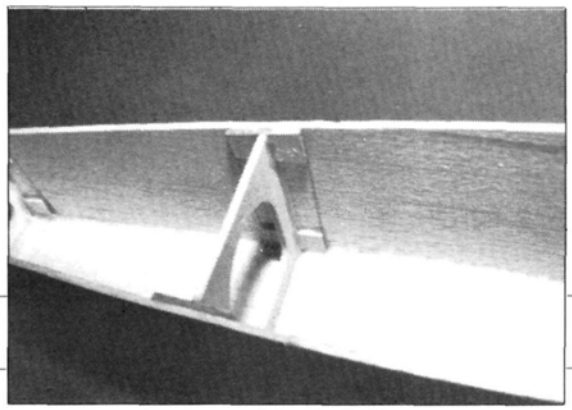
Extremely rugged wing center section utilizes dihedral braces and bottom sheeting. The top center section is unsheeted.



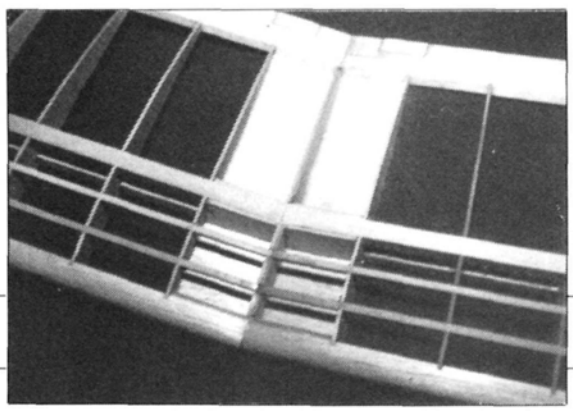
Nose section uses ¼-inch balsa triplers to capture and strengthen motor mount plates.



Trailing edge ply scabs are used for protection against rubber bands. Leading and trailing edges are notched for ribs.



Former installation uses light ply locking plates to avoid notching fuselage sides.



Note pre-shaped leading edge. No carving is necessary, just final sanding prior to covering.

notched for the ribs. The fuselage sides are machined 1/8-inch balsa sheet, while the doublers and formers are 1/8-inch die-cut light ply. Wing ribs are die-cut 3/32-inch balsa. Tail surfaces are machined 1/4-inch sheet. The wood quality and die-cutting are excellent. The box is packed efficiently with wood sheets stacked together and strip stock rolled up inside the plans. Two poly bags of miscellaneous machined parts and a bag of hardware are also included. The excellent instruction manual has 40 pages of text and photos, with ample hints on finishing and flying. The plans are very clear and easy to understand. In light of this, I feel it's necessary to touch on a few points rather than give an account of the entire construction.

CONSTRUCTION. The fuselage is started by installing the die-cut light ply doublers, balsa nose triplers and former lockplates to the inside faces. I found the use of notched lockplates to be a novel but very appropriate way of keying the formers into place. In the beginning construction phase the fuselage is almost entirely assembled dry (without glue) by fitting together the interlocking parts. This includes the sides, firewall, formers, light ply front bottom, landing gear block and balsa aft bottom sheet. Rubber bands are used to hold the fuselage together during this step. To make the bottom parts fit absolutely perfectly, I sanded just a tad off the alignment tabs, slightly relieved the doublers in the area of the landing gear and cut approximately 1/16

(Continued on page 82)

FLOATING

(Continued from page 39)

rudders to the air rudder, leaving your aileron control independant, and give it a try.

There's another generality regarding biplanes in that many of them have a staggered wing setup when viewed from the side. This makes it easy to mount the forward gear directly to the fuselage, but the rear gear usually winds up under the wing at about two-thirds chord. If you're adapting a biplane to floats, it might be a good idea to install some end-grain balsa blocks in the wing at that point and use that position to install your wing hold-down screws. That way, one set of bolts will perform both functions.

Finally, I'd like to expand on a recommendation I made several columns ago to position your gear to allow no more than 2 inches clearance between the bottom of the prop arc (largest prop you'll use) and the float deck. The recommendation applied to any floatplane regardless of size, and was based on a cut-and-try experiment with my first floatplane, a .20-size Fairchild Ranger. I found that if the thrust line was positioned too high in relation to the floats, a pitching or rocking moment would result when transitioning to step planning that was nearly impossible to control with elevator. The 2-inch clearance was found to be adequate even in choppy conditions, and so it follows that as the scale of a floatplane increases, the distance from the prop to the water increases also, given adequate flotation. Remember that water tends to shatter wooden prop tips so it's wise to use the fiber-filled plastic props on your floatplane, or at least check your wooden props after every flight.

John Sullivan, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. ■

JET BLAST

(Continued from page 31)

July 11 and 12—"Judy Jet Scramble." For info contact Dave Bloomer, 604 S. East St., Plainfield, IN 46168, 317-839-4449.

August 12 to 16—"Byron Original Jet Rally." For info contact Mark Jensen, Box 279, Ida Grove, IA 51445, 712-364-3165.

September—"Fifth Annual SW Fun-Fly" to be held in Ft. Worth, TX (info forthcoming).

For peak performance, stay tuned!

Rich Uravitch, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the companies mentioned in this article:*

Roy Hartmann, 18612 Vixen Dr., Pacific, MO 63069.

B-Line Products, P.O. Box 1231, 823 Main St., Roseville, CA 95661.

Jet Hangar Hobbies, 12554 Centralia Rd., Lakewood, CA 90715.

JMI, 7001 Acton Rd., P.O. Box 224, Dalzell, SC 29040.

Nick Ziroli Models, 29 Edgar Dr., Smithtown, NY 11787.

Davis Diesel Development, P.O. Box 141, Milford, CT 06460. ■

SOARING NEWS

(Continued from page 66)

starts flat, stays flat. This type of construction also guarantees relative freedom from warping. The two cork faces afford a new and fresh building surface merely by turning the board over...but they also prevent warping by providing a completely symmetrical board in thickness. Otto discovered that with only one cork face, slight warping could still take place, so he added another. He's one of those machinist-type craftsmen who insist that things be "Jo-Block" flat, which is why he cuts and custom-fits each board. The weight insures that the board will stay put on whatever surface you put it, workbench or between two saw horses.

These quality building boards will last a very long time, and when the cork surfaces are all used up, scarred and battered, you can merely remove the old cork faces and install new ones...getting them from Country Hobby or your local supplier.

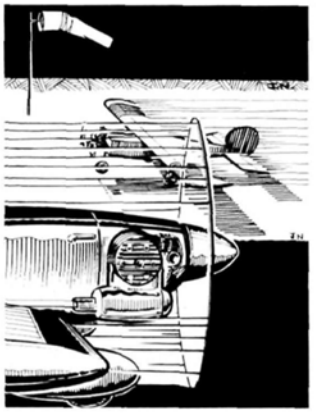
The price? Well, it's best to write and ask, especially because of the comparative U.S. and Canadian dollar values, but it will cost you less than $50 U.S. currency. While you're at it, ask Otto if he will build a custom board to your own specs. The 1x4-foot dimensions are nominal, but I'm sure he could make one smaller or larger for a given purpose. They will ship via UPS from Ontario, so there's no problem. For the first time in years, my wings are coming out flat and true. It's great not to have to compensate for built-in elliptical dihedral or unequal washout because my building surface wasn't flat and true. (Be sure to cover the cork with waxed paper before you glue it....)

Jim Gray, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the companies mentioned in this article:*

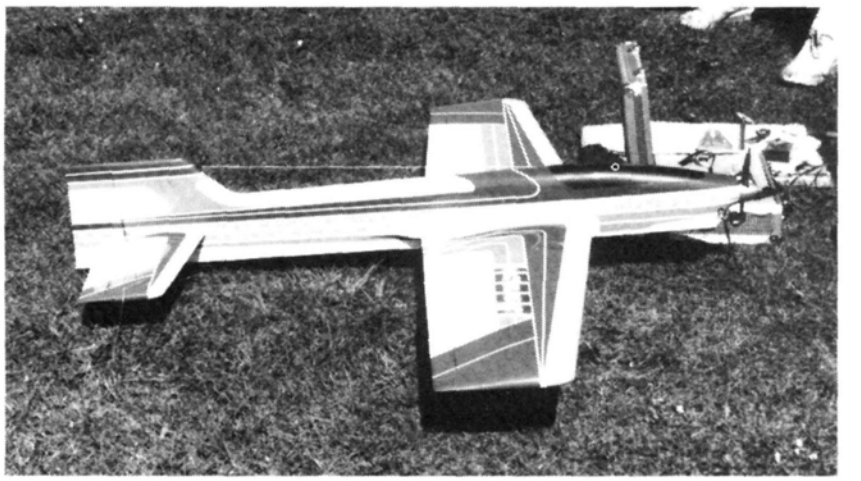
Buzz Waltz, R/C Designs, 255 N. El Cielo, Suite 476, Palm Springs, CA 92262.

Country Hobby Supply, R.R. #1, Dunds, Ontario, Canada L9H 5E1. ■



Pattern Matters

by MIKE LEE



Craig Millet's original design pattern ship is unusual. It appears closer to a modern control-line stunt design. Ship flies quite well.

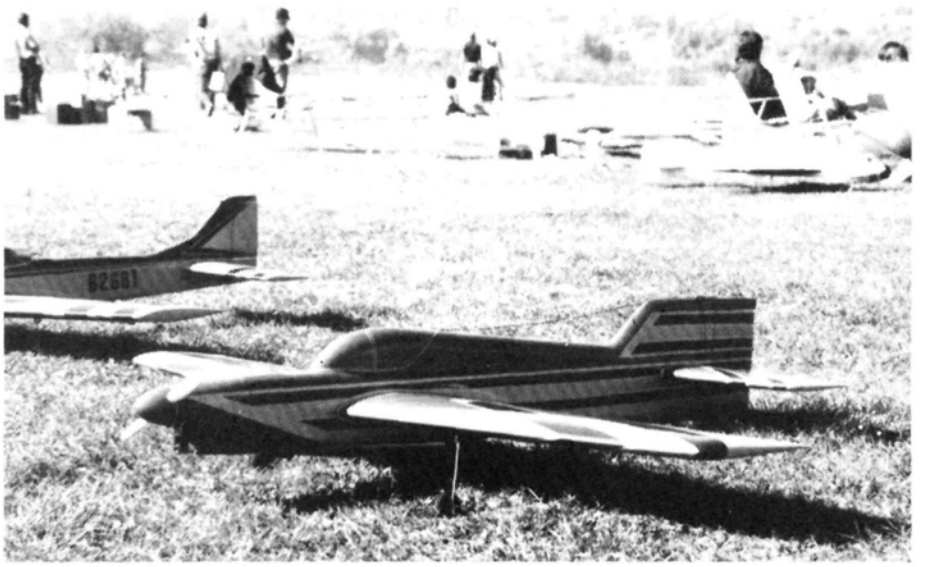
WHEN THIS column started in 1984, I said that our sport was in a constant state of evolution. The need to fly an aircraft which flew to our style with ease and comfort caused us to develop aircraft which are currently the most efficient aerobatic ships in the world. But apparently the need still exists and evolution continues.

Note the photo of Craig Millet's gorgeous and unusual ship for AMA Masters flying. If you look closely, you'll find that Craig's ship resembles the current Ukie stunt ships. Note the low-profile fuselage, long and broad fin/rudder, and wing planform. Flight performance proved this to be a very air-efficient ship. It's fast and smooth, yet suffers no yaw stability problems at low speed with the fin setup.

This is interesting in that this planform has been in existence for some time within the control-line fraternity. Granted, most designers probably assumed that this design was meant to hang from the end of 65-foot lines and not have to worry about flying untethered. As Craig has shown us, the design is quite suitable for pattern use untethered, and is capable of winning performance. Craig has placed often and consistently with the bird.

The next photo shows another aircraft, this one by Ken Wilson, following the control-line design. Ken calls his ship the Marquee, and it flies very well indeed. Like Craig's ship, the Marquee is fast, smooth, and almost too stable in the yaw mode. Personally, I like to see my tail wag every once in a while, like out of a stall turn. The Marquee almost refuses to wag.

What I'm showing you is where our future may be heading. These two ships are only what I've seen so far in my area, but pictures of the European ships seem to reinforce this line of thinking and we may see the European designers picking the brains of our control-line designers in order to see what can be derived. No doubt our current designs are on the move and we can expect some really outstanding aircraft to begin making their appearances by next spring.



Ken Wilson's original design, the Marquee. Like Millet's aircraft, it too looks similar to a control-line stunter.

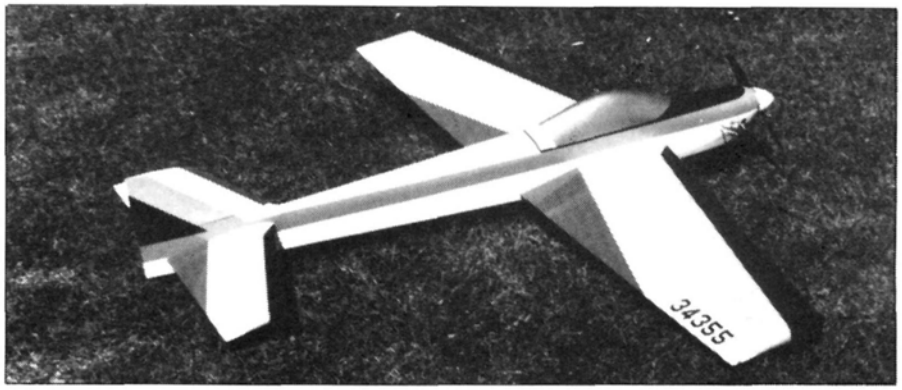
While I'm speaking of rather revolutionary things, get a load of our third photo this month. This is the new ship of Chip Hyde, one of our top pilots in FAI. The ship is a Dash, designed by T. Yoshioka. Now, if you look super close, there's something you won't see—hinge lines! That's because there are none. In fact, there is no control surface to hinge. Merle Hyde has modified the Dash to the point where the ship pivots the wings for roll control, the stab for pitch, and the whole upper fin for yaw control. In other words, it has all flying surfaces.

Merle managed to achieve his all-flying-surface ship by a clever system of lever arms to the surfaces. Too sophisticated to describe here, the system uses two servos for the wings, two for the stabs, and one for the fin. The retracts have one servo each and swing from front to rear on the wings. Merle says that this arrangement prevents excessive loads from being inflicted on the retract units

during a skid. Not a bad idea, but what about rocks!

Anyhoo, the modified Dash flies quite nicely through the FAI pattern, apparently the flying surfaces working as designed. Only the rudder makes its presence known in the point rolls, as a pretty audible "whoosh" when deflected. Again, this looks to be a possible trend for the future. No more control surface gap or flutter (hopefully), and an overall cleaner airframe. Things are definitely looking up.

Ken Wilson and his Marquee. Note huge vertical fin.



Chip Hyde's new Yoshioka design, called "Dash," is unique in that it uses a wing pivot system and all flying control surfaces.

Noise Rules

Well, I asked for it and I got it. In our October issue, I discussed the new FAI rules for noise and enforcement of those rules. Admittedly, the new rules are pretty awesome in that you will find out the hard way if the model you fly really does cut the noise mustard or not. The poor airplane gets impounded first and thrown out second if it fails. This prompted the following letter from Paul Maharis of Ken Gardens, New York.

"...all these rules seem to be pushing pattern fliers into a corner. I'm talking about the new noise measurement. If my plane does not pass the noise test, I sure would like to know about it at that moment. Maybe the problem could be fixed in a minute or two. And what's this about impounding the aircraft and transmitter? Do they lock up the flier, too, under armed guards?

"Mike, honest, I love my aircraft and take lots of pride in building my transmitter and airborne system. *No one* impounds my equipment unless I go with it and no one starts my ship and messes with my transmitter but me! What's going on here, Mike? Since when have pattern fliers gotten so loose in their thinking that they let a few get away with these crazy ideas? I think that we're in for a loss of fliers, especially new ones, if we don't have an equal say on some matters."

Well, Paul, first let me say that this column has made your opinion known and almost anything in print carries some weight. Now let me explain a few points.

There is no doubt that you do indeed take great pride in your equipment, as most of us do. Sometimes, I feel the same way about letting anyone mess with my plane, let alone lay a finger on the almighty trims. But, the situation isn't quite this bad.

The rules apply to the FAI class pilots only. Granted, there is the possibility that all of us playing the game today will fly the FAI pattern some other day. But, therein lies the problem. When you have a number of pilots playing the same game, someone is going to try and get an edge on the rest. In the noise area, this test bit has been successfully circumvented by using several methods.

The easiest method was using an in-flight needle-valve adjustment to fool the meters. The pilot simply richened up the engine until the measurement was made and then leaned it out once airborne. Another method was a simple change of props. The pilot would ding the prop on the way to the launch area and hastily make a prop change to the right prop, all this after the noise measurement was made. Still another way was using a variable-pitch prop. There are more, but you get the idea. If there is a will, there is a way to bend the rules.

The impounding law simply prevents the pilot from modifying the ship in order to meet the noise test at the field. Noise is a big subject on the part of losing flying fields. I've seen where a flying field was lost to a single noise complaint on a single aircraft where the local club had been flying for years. One loud one is all it takes. The rules insure that you either comply or you don't fly. A bit tough? Maybe so, but the rules must protect the

(Continued on page 129)

Hyde's father Merle explains how the airplane flies without ailerons.

Giant Steps

by DICK PHILLIPS

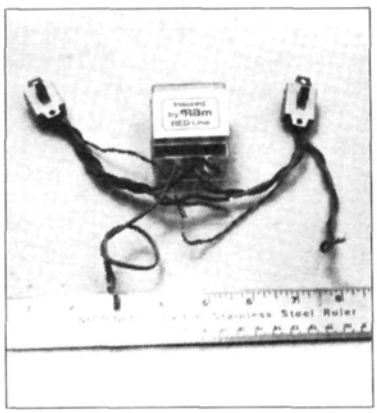
I HAD A letter a while back from John Doherty who lives in Cambridge, New Zealand. For some reason, I didn't have John's correct address and my letter to him was returned.

John's question was a good one and one I felt should be passed on to others. He had asked why there is a need for a redundant battery system, why not just put a pair of batteries in parallel and accomplish the same thing, which is increased battery capacity?

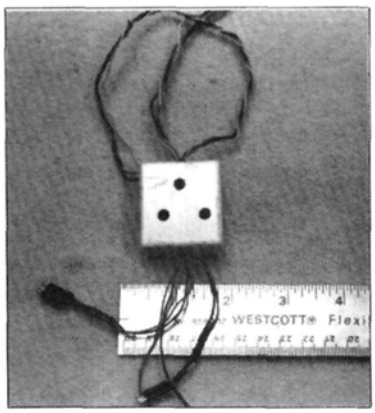
I pointed out to John that it wasn't quite the same thing. Two battery packs in parallel would admittedly provide double the battery capacity, but not the same safety factor as a redundant battery system.

With two packs in parallel, any problem with one of them would be passed to the other. A short circuit or an open circuit would disable the pack and the receiver would be without power. On the other hand, a redundant battery system controller monitors the condition of the batteries connected to it. Should there be a problem with either of the batteries, the controller removes that pack from the system and continues on the remaining pack—surely a good idea. So long as we remain aware of what the controller is doing, we can replace a battery when it creates a problem. Without the controller, a battery dies and an airplane soon follows suit.

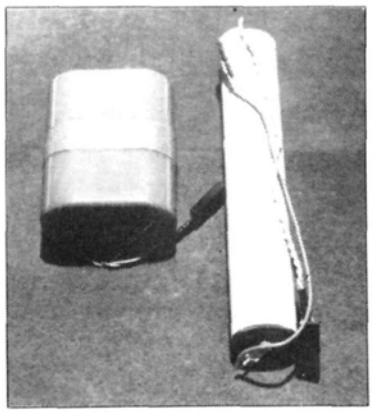
The two major redundant systems are made by Ace R/C* and Ram*. The two companies have different philosophies and there are points in favor of each of them. Both units have two identical batteries connected to them (that is, identical in size and capacity). The similarity ends there. Ram has one of those two batteries on line to the receiver. Should that battery develop a problem, the system removes it from the circuit and immediately places the other, stand-by battery on line. This



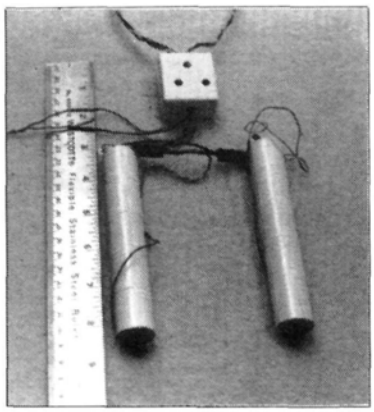
Ram Models battery backup system has heavy-duty wire and two battery packs.



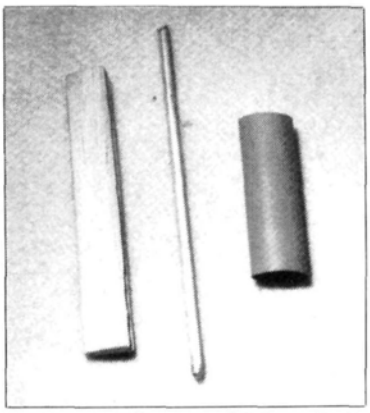
Ace D/C battery backup system uses two five-cell packs. LEDs indicate condition.



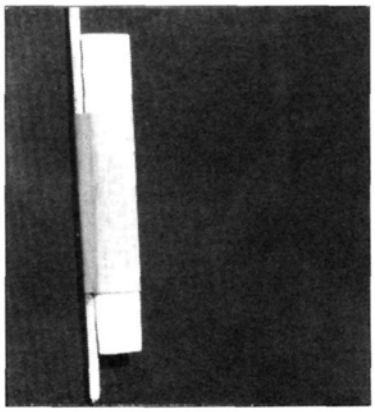
Standard 500-mAh (l) and 5-cell 1,200-mAh (r) packs; 5-cell for Ace system.



Ace system hookup. LEDs glow to indicate which battery is bad.



Components for strut fairing attach method as covered in text.



Strut shown with fairing attached by heat-shrink tubing. See text.

takes very little time and the flier would not be aware anything had happened. (It's necessary to check the condition of these batteries to assure that a bad cell is replaced immediately a problem develops.)

The advantage of the Ram system is that only one battery is on line at any one time. This means that when a problem occurs with the primary battery, it is replaced with a freshly charged battery. In addition, the battery packs used are standard packs.

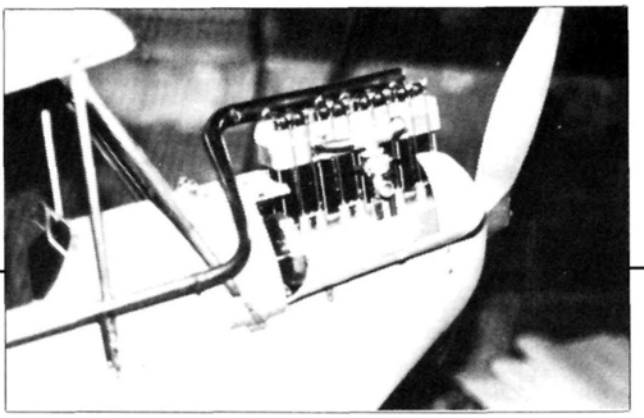
The Ace system has both batteries on line all the time. When one or the other develops a problem, it is removed from the circuit and the receiver continues along on the remaining cell. This system has the advantage that it provides some additional capacity to the receiver. This is claimed to provide a higher voltage to the receiver and to provide slightly greater range.

The Ace system requires five-cell packs as opposed to the standard four-cell packs we normally use. The extra cell boosts the output of the pack slightly which is where the extra voltage and range come from.

Comparing the two systems, the Ace controller is somewhat less expensive than Ram's. It's also available as a kit which can be assembled with minimal difficulty by anyone who can read and make good solder joints. Both do a perfectly adequate job and both are reliable systems. Considering the unlikelihood of two battery packs having a problem at the same time, these systems are as near perfect protection against battery failure as is available. Why anyone would consider flying *any* model without this readily available and inexpensive "insurance policy" is a mystery.

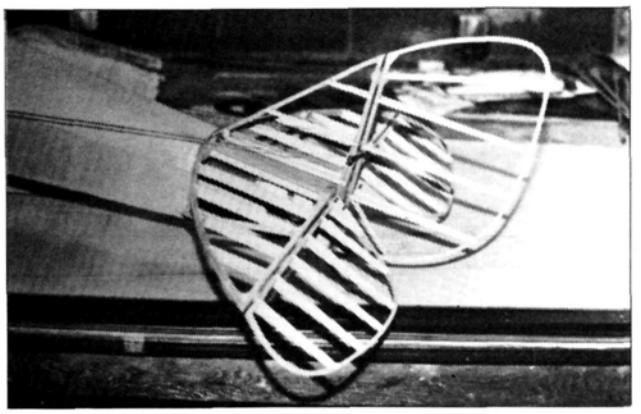
One of my regular correspondents recently told me a story about a club member who had replaced the batteries in his radio systems with some Ni-Cds he had picked up as a "bargain." Being

(Continued on page 129)

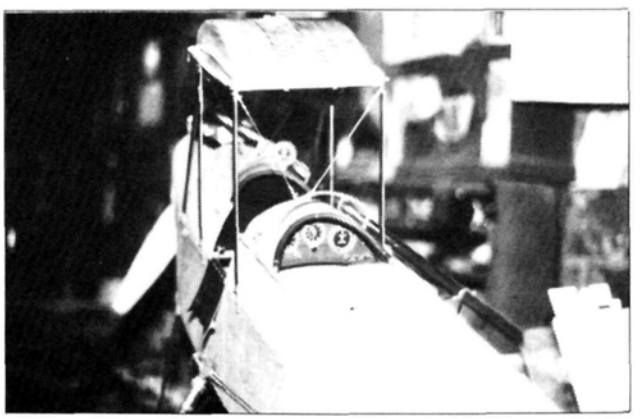


Merritt Zimmerman's DeHavilland Gypsy Moth and working hand-built in-line engine. Note open cowl and carb.

Work progresses on the Zimmerman Moth. Many parts are hand-fabricated by this outstanding craftsman.



Tail group of the Zimmerman Moth. Note the external control cables as would be found on the full-scale aircraft.



Meticulous workmanship is obvious on Merritt Zimmerman's Moth. Aircraft is very close to museum quality.

PT-40

(Continued from page 75)

inch from one end face of the block itself. I could have skipped this detail trimming at the expense of having to squeeze a little more gap-filling cyanoacrylate glue into the spaces.

After the parts are all fitted properly and the alignment is checked over the fuselage top view, then thin cyanoacrylate is applied to all the joints. This is then followed by thick cynoacrylate and a spritz of accelerator to create glue fillets. At this point the fuselage is about three-quarters complete and requires only the balsa windshield, hatch, motor mount plates and landing gear to be installed. The aft top sheet isn't installed until after the pushrods are fitted.

The next construction steps involve installation of the tail surfaces. The fin is completed by joining two pre-cut pieces of ¼-inch sheet. The stabilizer is similar but has the addition of ¼-inch-square tips with the grain running chordwise for warp resistance. Note that on page 15 you should read and follow all of step 5, sections A-E, prior to gluing the stab on permanently in section F. The first sentence in step 5 could lead you to glue it before checking its alignment with the aircraft centerline. The instructions for aligning the fin are more foolproof.

The fuselage and tail are a breeze to build. Once done with them, you can flip the plans over and start the wings. Both panels are shown so you can build them concurrently if your building board is large enough. The wing has upper and lower 3/8x1/2-inch main spars and two 3/16-inch-square forward turbulator spars, all of basswood. The only wing sheeting is on the bottom of the center section. A nice feature of this kit is that the leading edges and trailing edges are milled to shape and notched for the ribs. To begin, the ribs are positioned on the lower main spar over the plans. Then the LE and TE fitted, followed by the top main and turbulator spars. These parts are all assembled dry and then glued together with thin CA. I also applied a second coat of thick cyanoacrylate and accelerator to form glue fillets between the spars and ribs.

Light ply dihedral braces are glued onto one of the wing panels in preparation for joining. The choice of whether to use ailerons will determine which set of braces to install and how much to block up one wing panel when gluing them together. After joining the two panels, the center rib is added and ⅛-inch sheeting is installed in the first rib bay, between the ribs and flush with their bottom surfaces. I thought it a bit unusual to have no sheeting on the top of the center section but I haven't encountered any problems with this approach. The center section appears to have sufficient strength as designed and because of its rather massive wood sizes, the wing is very strong overall.

With the wing built, you can proceed with the radio and engine installation. The engine is mounted on ¼-inch-ply breakaway bearers. Depending on the size of the crankcase, some bearer material may have to be removed. A minor amount of trimming was required to accommodate the K&B .40 that I used. The engine is screwed to the bearers with machine screws and blind nuts, while the bearers themselves are held to the ply mounting plates with sheet metal screws; therefore, it is relatively assured that a crash will pull the engine off without taking the whole nose with it.

A light-ply servo tray is provided, with a cutout for three-abreast servo placement. Although it is not mentioned in the instructions, I glued scrap reinforcements under the tray to provide extra thickness for the mounting screws. The radio com-

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PT-40

(Continued from page 82)

partment has lots of room in which to work. I had no trouble installing one of my older Kraft* radios with three KPS 14 servos and a rather large receiver. The kit includes dowels and threaded wire ends to make the pushrods. These are easy to fabricate and a cinch to install while the aft fuselage top is still uncovered. A single pre-cut piece of top sheeting is then glued in place. If ailerons are used then the fourth servo is to be side mounted on the bottom of the wing.

I covered my model with Top Flite* Super MonoKote and trimmed it with a combination of MonoKote trim sheet and Carl Goldberg* striping tape. The exposed wood in the engine bay and fuel tank compartment was painted Hobbypoxy* white for fuel protection. The instruction booklet clearly indicates how to twist washout into the wing panels after covering.

FLYING. I was eager to try this three-channel trainer and play the role of beginner again. I planned on deliberately making some typical beginner's mistakes and testing the model's ability to recover.

As I advanced the throttle for the first flight, the PT-40 moved out smartly and stayed in a relatively straight line without steering corrections. After about 50 feet or so it looked very light so I gave a touch of up-elevator to get it off the ground. I then released the elevator and the model continued to climb out at full power, still in a relatively straight line.

With the model about 200 feet high and 500 feet away I decreased the throttle setting to one half and started a 180° left turn. When I released the rudder, it leveled off on a heading roughly back toward me. It had corrected itself pretty well. The rest of this flight was spent doing low fly-bys and circles enabling Rich Uravitch to get flight photos. This was a good test of stability, and I found that the PT-40 could be slowed down to a crawl while still maintaining full control authority.

On succeeding flights, I intentionally put the PT-40 into awkward attitudes to see how well it would recover by itself when the controls were neutralized. I was impressed by this excellent primary trainer. The stall is very gentle. It won't drop a wing tip, but instead will mush straight ahead. After the nose drops a little it will lose about a hundred feet of altitude and then slowly climb back up. The airplane will gradually recover from a steep bank after considerable loss of altitude, and the recovery will be accompanied by a moderate increase in speed and then a shallow climb. This, of course, assumes that the pilot releases the controls and cuts the throttle. That's a lot better than screwing itself into the ground. Whenever one wing is too low, either due to a pilot mistake or a wind gust, that wing will gradually lift itself up and be neutralized. However, since the PT-40

(Continued on page 88)

PT-40

(Continued from page 86)

reacts so gently, the pilot will have ample opportunity to take corrective action without waiting for the model to right itself naturally. Rudder correction is very effective at leveling the wings.

While it is probably stretching the point to say that the model won't let you lose control, it is certainly true that there is a tremendous safety margin for pilot error. It is always a good policy for the beginner to fly with enough altitude for the aircraft to recover by itself if need be. The PT-40 has remarkable self-recovery characteristics.

With such good manners, the PT-40 also makes landings very easy. In calm air the landing approach can be made with the engine at idle and practically no action is required of the pilot until final flare at touchdown. To make matters even easier, full-up trim can be put in at the transmitter and the model will gently settle onto the field by itself. Of course, you have to pay more attention on a windy day. The model does handle very well and with suitable throttle and rudder corrections the landings are equally good.

The point of the above is to confirm that the PT-40 is a gentle flyer that makes an ideal primary trainer and is very tolerant of pilot errors; however, I was quite surprised at its aerobatic capabilities. With the K&B .40 going full blast, I was easily able to do rudder rolls, immelmans, both inside and outside loops and sustained inverted flying. This was a lot of fun and illustrated that the model was no dog just because it didn't have ailerons. Much of this maneuverability is attributed to the power of the .40 engine and a .25 to .35 is more suitable for training flights.

After several weekends of flying, I have nothing but praise for the Pt-40. It is about the easiest to build of any wood kit that I have put together. It's also one of the most gentle and forgiving that I've ever flown. It is responsive enough to give the pilot the feeling that he is in control yet spunky enough so that he won't grow out of it after learning the basics. Great Planes has named this one well.

**The following are the addresses of the companies mentioned in this article:*

Great Planes Model Distributors Co., P.O.

(Continued on page 104)

Product News

KYOSHO PATRICIA 10

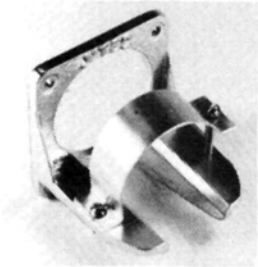
Kyosho's new Patricia 10 is a great solution for the beginner who wants to have fun with a great-looking trainer. This beautiful 70-inch wingspan ARF kit features a factory-built fuselage, stabilizer and strong D-tube design covered, balsa wood wing that's built on jigs for aerodynamic flight. The one-piece fuselage is molded from a super-tough, nearly indestructible material which is still very light in weight. A stable and slow flier, the Patricia takes off with a hand-launch and lands easily at a slow speed. Easy spring starter and eight degrees of dihedral add to the characteristics that make this a great trainer. Two versions of the Patricia 10 are available: with or without an O.S. .10 FSR engine. The Patricia has a total weight of 2.5 pounds and requires a three-channel radio. Distributed to leading retailers nationwide by Great Planes Model Distributors (P.O. Box 4021, Champaign, IL 61820).

F-15 SPORT EAGLE

Designed by George Miller, this is a simple, all-wood airplane with a fiberglass duct tube. It won "Best Original Design" at MAC Show. Perfect D/F Trainer with Turbax I and K&B .45 or excellent Sport Flyer with Dynamax O.S. .77 and retracts. It can be built in a weekend too. It spans 42 inches with a length of 54 inches and weight of 5-6 pounds and is very affordable. Send $3.00 for complete catalog to B-Line Products (P.O. Box 1231, Roseville, CA 95661).

PITTS STYLE MUFFLER

Designed to fit all .75 to 1.3 two-cycle engines such as ST-Como 75-90, Max 90-1.08 and Super Tigre 3000. This muffler is for side-mounted engines normally used in Pitts, CAP 21, Cessna 150 and similar aircraft. Large volume rear and tapered front design provides quietness yet gives more room in front end of cowl. Twin exhaust tubes for scale effect. This muffler is made of aluminum and is bolted directly to the engine, clean and easy. Included are mounting bolts, exhaust pipe extension tubing and tubing clamps. Available at your local hobby shop or order directly from J'TEC (164 School St., Daly City, CA 94014).



NEW FROM J'TEC

This versatile motor mount from J'TEC (164 School St., Daly City, CA 94014) provides a firm firewall mounting and allows a variety of electric motors to be used on the same mount as it is designed to accommodate all popular 05, 075, plus 035, 05 and 15 cobalt motors. The large hole in the rear of the mount allows the motor to be moved forward or backward for proper CG balancing or to fit the design of the plane. The motor is then tightened down with the aluminum strap. This electric motor mount is cast in aluminum, and weighs only 1 ounce.

A&B POXY PUTTY

This is an epoxy putty system for shaping and contouring, consisting of bars of part A and part B. Equal size chunks are cut from both bars and rolled between the hands to effect mixing of the heavy-bodied components. As the mass is rolled and mixing accomplished, the putty attains a uniform color without striations or streaks of differing color. The system is a low-density type and offers superior sandability and carvability. While rolling to mix, wood stains can be introduced to match and obtain museum-quality repairs to wooden objects. The putty is claimed to be excellent for kit bashing plastic model parts to yield different variations on a basic model's design. The superior workability of the system makes it ideal for miniature figures construction, diorama, and R/C aircraft applications. The putty dries hard and resistant to all paints, and does not crumble, chip, or crack like solvent-based systems.

The chemistry of the putty permits "hydro-smoothing"; that is, water is used after the putty is in position or as an assist to bonding to porous surfaces. Using water, the putty takes on the action of a ceramist's clay for final surfacing. Excellent for sealing seams in plastic model kits. Available at your local hobby shop or from Penn International Chemicals (943 Stierlin Rd., Mt. View, CA 94043).

APPLICATION TRENDS

PIC's new application accessories include disposable brushes for use with

epoxies, aliphatics, paints, parts cleaning, etc. A full ⅜ inch wide and 6 inches long, they're sold in packs of 12 brushes. PIC Squeegees answer the need for a top quality hobby spreader/ burnishing tool. Injection-molded of a proprietary plastic to maintain a true edge, the squeegees have a unique twin-ribbed cross section to offer positive hand control. Sold as packs of three assorted sizes, 2x3, 3x4 square corner, 3x4 round, the distinctive yellow products are packed in a reuseable plastic box. PIC Mixing-Hobby Sticks offer excellent value in extra width and extra length. Used to mix epoxies, stir paints, etc. Made of American white birch, the sticks are sold as 75 pieces per bag. PIC Mixing-Measure Cups are the same familiar disposable, fully graduated, polypropylene cups found in the industry; they're useful for mixing epoxies, paints, parts storage, etc. Available in 8-ounce size and 1-ounce Little Pups in sleeves of 100 or 50 cups. Economically priced from Penn International Chemicals (943 Stierlin Rd., Mt. View, CA 94043).

ABRASIVE CORDS, TAPES

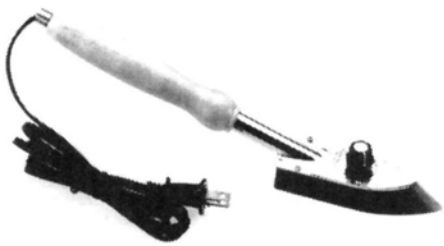
A complete line of abrasive cords and tapes for cleaning and finishing deep grooves on wood, metal, or plastic is available from E.C. Mitchell Co., Inc. (88-90 Boston St., P.O. Box 607, Middletown, MA 01949). Mitchell's Abrasive Cords and Tapes eliminate the bother of trying to fold and fit ordinary sandpaper into deep grooves. Featuring cords from 0.012 to 0.150 inches diameter and tapes 1/16 inch to ¼ inch wide, 18 different sizes are offered to match any job. Impregnated with aluminum oxide or silicon-carbide abrasives and crocus for ultra-fine polishing.

CONQUEST 6NLK/FM

The Conquest 6NLK uses high-noise-rejection FM and includes the Futaba R107N Receiver and four S138 precision servos as standard equipment. Specs: six-channel R107N Receiver, four S-138 servos, two dual rates, six-channel servo reverse; 50, 53, and 72 MHz. See your dealer about this new offering from Futaba Corp. of America (555 W. Victoria St., Compton, CA 90220).

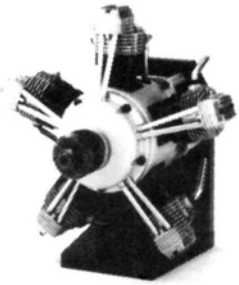
NEW G-153BB (G-133BB)

Futaba's (555 West Victoria St., Compton, CA 90220) gyro stabilizers provide the minute attitude corrections a ground pilot would give if he were actually in the cockpit sensing the plane's movements. The G-153BB is a new precision ball bearing, single axis with a J-connector; the G-133BB uses standard 3-pin connector. Power is 4.8V shared with a receiver or 6V external. Current drain, 20 mA (amplifier at 4.6V), 100 mA (motor). Gyro body, 1.57x1.65x 1.60 inches and weighs 1.61 ounces. Control box, 0.94x1.34x0.59 inches and weighs 0.54 ounces.



SEALING IRON

From Great Planes Model Mfg. Co. (P.O. Box 4021, Champaign, IL 61820) the custom Sealing Iron easily provides the smooth, super-tight finishes desired by serious modelers. An unswept front keeps the iron from digging and marring finishes; a pointed tip and cone-shaped nose facilitate work on corners and other hard-to-reach areas while a Teflon coating helps prevent scratching and adhesive build-up. The Sealing Iron's thermostatic control knob makes it easy to determine optimum temperature and maintain even, constant heat. The Sealing Iron is a lightweight 11 ounces and features a smooth, comfortable wooden handle. See it at your local hobby shop!



O.S. FR5-300

The O.S. FR5-300 four-cycle is truly an engineering masterpiece. This radial 5-cylinder engine weighs 77.5 ounces and operates at 1,800-8,000 rpm. The FR5-300 is perfect for giant-scale applications. It produces high torque output throughout the rpm range, can swing a large prop and produces a realistic sound. The FR5-300 provides the ultimate in scale appearance, performance and realism. Four-cycle and giant-scale enthusiasts will love this engine for all the fine O.S. qualities it possesses. Distributed to leading retailers nationwide by Great Planes Model Distributors (P.O. Box 4021, Champaign, IL 61820).

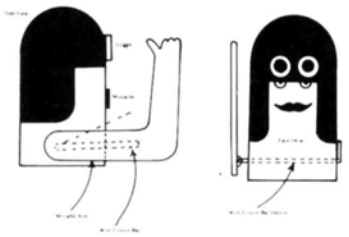
GLOW-DRIVER POWER PANEL

This new power panel from Hobby Lobby International, Inc. (5614 Franklin Pike Circle, Brentwood, TN 37027) has all the things that you usually find in a power panel, and this one includes a glow driver and a fuel pump too.

Product News

SUPER OLYMPUS

Super Olympus produces one and a half times as much power as the Olympus! The Super Olympus is exactly the same as the HLH705 Olympus electric aircraft motor, except that it is the more powerful MFA RX-15. This is a 110-watt Mabuchi RX-540 racing motor with special brushes, bearings, magnets, and timing (which can be fine-tuned for maximum rpm). The regular Olympus produces the power of a .15 two-stroke engine and the Super Olympus produces the power of a .21 two-stroke. Super Olympus using 7.2 volts will give more power than an Olympus using 8.4 volts. And Super Olympus can be run on 8.4 volts giving the maximum power of a .21. New from Hobby Lobby International, Inc. (5614 Franklin Pike Circle, Brentwood, TN 37027).



"GOOD GRIEF, SNOOPY!"

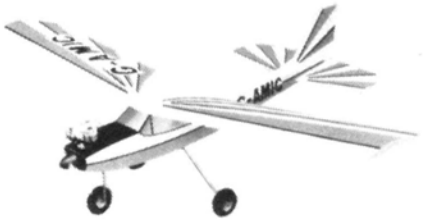
The Black Baron himself, a molded plastic figure just under 3 inches tall with separate goggles, mustache and right arm that can be rigged to wave at the crowd as the Baron's plane roars by. The pilot figure is part of the bricabrac that goes with Coverite's super trainer "The Black Baron Special." Send your order to Coverite (420 Babylon Rd., Horsham, PA 19044). No CODs.

YALE WEIGHT

Yale Weight is a nonmetallic, two-part, epoxy compound for adding tip weight to your main blades. Equal parts of each must be mixed together. The kit includes a complete set of instructions, mixing cup, stick, and approximately 30 grams of epoxy compound, enough to do one set of blades. Yale Weight complies with AMA/FAI rules for adding weight to your blades and cannot be detected by a metal detector. Most important to Yale Hobby is the safety factor. Yale Weight is specially formulated so that it doesn't delaminate from the rotor blade during flight. Write for info to Yale Hobby Manufacturing, Inc. (20 Holly Lane, Wallingford, CT 06492).

ROYAL TELSTAR .40 ARF

The Telstar from Royal Products Corp. (790 W. Tennessee Ave., Denver, CO 80223) is a buy-today/fly-tomorrow pattern ship that features lightweight foam/plywood construction with pre-painted high-gloss, fuel-proof finish. All necessary hardware including wheels, tank, motor mount, plus an illustrated step-by-step instruction manual is included. All surfaces are prehinged and the model comes set-up for retracts (fixed gear supplied). A highly maneuverable yet easy to fly design. Specs: span 58.4 inches, length 51 inches, wing area 593.6 square inches, engine size .40-.45 two-cycle or .60 four-cycle, channels 4 or 5.



MINI SUPER-TRAINER

The 47-inch-wingspan trainer from Hobby Lobby International, Inc. (5614 Franklin Pike Circle, Brentwood, TN 37027) goes together in a jiffy! The wings come pre-sheeted with veneer—just join them together. The fuselage is "snap-together" light plywood. Mini Super-Trainer is for three channels of R/C control (rudder, elevator, and throttle) and for engines in the range of .09 to .15. The airplane is a good trainer because it's stable. Also, by omitting ailerons, which are something of a chore to install and hook up, and by having a rigid, fixed nose gear (steerable ones take time to hook up) the Mini Super-Trainer gets built and flown fast!

IMPROVED GLASSKOTE

Coverite (420 Babylon Rd., Horsham, PA 19044) has improved its Glasskote formula. The popular clear now dries in only 15 minutes, producing dust-free finishes that are extremely scuff resistant. All the other special qualities of this premium topcoater have been retained. It is high-gloss, fuel-proof and goes over most paints and is 94% clear. Glasskote can be brushed, leaving no marks at all, or sprayed. It is 1-part so no mixing is required. Glasskote is available in the familiar orange ½-pint cans.

PT-40

(Continued from page 88)

Box 4021, Champaign, IL 61820.

K&B Manufacturing, 12152 Woodruff Ave., Downey, CA 90241.

Kraft R/C Electronics, 1685 Beckwith Dr., Hudson, OH 44236.

Top Flite Models, Inc., 2635 S. Wabash Ave., Chicago, IL 60616.

Carl Goldberg Models, Inc., 4733 West Chicago Ave., Chicago, IL 60651.

Hobbypoxy: division of Pettit Paint Co., P.O. Box 378, 36 Pine St., Rockaway, NJ 07866. ■

SMALL STEPS

(Continued from page 25)

Kenhi. I know from my own experience how valuable the feedback from modelers can be. It's hard to know if you're doing the right thing unless someone tells you.... Today's model kit manufacturers keep very busy, and not all will reply to mail from customers. But they do pay attention to it!)

Returning to the Ace kits, I exercised my individuality somewhat on each of them. Modeling is a creative hobby, and I've never built a kit model without changing or improving something. For instance, I don't care much for the looks of the forward cockpit style of model airplane. Therefore I changed the Pacer fuselage to resemble a 1930-era aircraft such as the Northrop Gamma or the Lockheed Sirius. This wasn't a major design change, just a cosmetic alteration. Yet it personalizes the model for me and was well worth the extra time it took.

I can't tell you anything yet about the flight qualities of the three Ace airplanes but I hope to have flight test information for you in my next column, complete with photographs.

In conclusion I want to reiterate what my colleague Randy Randolph said in a previous column. Light weight is *the* secret of successful small R/C model flying. Keep weight down, add lightness, and don't let your model get heavy!

Accessories can add un-needed weight very easily. Wheels are a good example. Many model wheels on the market are far too heavy for small R/C models, and on my own airplanes I've been using Trexler airwheels for many years to save weight. But Trexlers are kind of fragile, so I was delighted to see the new lines of lightweight model wheels that have recently become available. Ace R/C, Inc. carries both of them: their own line of all-molded-plastic low-bounce wheels, and Dave Brown's new super-light series. Dave's wheels have nylon hubs and foam plastic tires, and weigh just ¾ ounce for a pair of 2¼ inchers. (The Ace wheels weigh 1.3 ounces per pair in 2¼ inch diameter.)

Keep in mind the byword for small-

size model flying: *every ounce counts!*

Joe Wagner, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following is the address of the company mentioned in this article:*

Ace R/C, Inc., P.O. Box 511C, Higginsville, MO 64037. ■

SIAI-MARCHETTI

(Continued from page 20)

fighter as most civilian pilots will ever fly. Its appearance is deceptively tame compared to its ability to retain speed and maneuver like a jet. It is quite simply the finest propeller-driven airplane ever built. Ask a guy who owns one! ■

.40 HISTORY

(Continued from page 64)

0.75 bhp at 15,400 less muffler, while the 40-PDP version reached 0.84 bhp at 16,500 rpm.

More recent HB 40s are more powerful. Following a period during which many improvements were made to these engines, a third version, identified by a black anodized cylinder-head and featuring a chromed cylinder bore, was introduced in 1983, appearing in the U.S. as the 40-PDP "Blitz" model. Improvements include a 15 mm crankshaft, new front end, a new piston and rod and a new HB carburetor.

Super-Tigre and Como

Perry (PDP) porting was also a feature of the 1979 Como 40, a sturdy front rotary-valve sport motor made by Super-Tigre for the American market. The Como's body casting had its origins in the discontinued rear rotary-valve G.40 model which, while not too popular in its original form, later provided the basic ingredients for some successful pylon racing specials.

Super-Tigre's G.21/40, as mentioned earlier, was in production at various times in various forms (including a rear valve version) over a very long period indeed. It saw the G.40 come and go, but has been survived by the X.40 which first appeared in 1974 as a rear disc-valve rear-exhaust pylon-racing engine, then later as a front rotary-valve model (the X.40FI), with tranverse muffler, for pattern use. The factory stopped listing X.40 engines a while back, but a revival of interest led to another batch of the rear rotary-valve pylon-racing model being produced during 1986.

Super-Tigre's most popular 40 at present is the front-induction side-exhaust S.40 which first saw the light of day in 1980 and was the subject of *M.A.N.*'s June 1981 "Engine Review" test report. The small muffler then supplied with the S.40 which, on test, knocked 30% off the engine's peak power output, has now been replaced by a larger and less restrictive one.

.40 HISTORY

Burford Taipan 40

This distinctive looking Australian made engine appeared in 1976 with all the state-of-the-art features of a modern R/C 40—Schnuerle scavenging, ABC, twin ball-bearing 15 mm shaft, two-needle adjustable automatic mixture control carburetor, etc. It was the end-product of a very considerable investment by the Burford company which, for twenty-five years, had been Australia's leading—and for most of this time, only—engine manufacturer. Unfortunately, the very cost of producing the 40, including the building and equipping of a new factory, was to prove an impossible burden and after only a short while, the company was forced to close so that, in the event, only a few hundred Taipan 40s were actually produced.

An unusual feature of the Taipan 40 was the location of the exhaust at the front of the engine where it would receive extra cooling and promote more balanced heat distribution through the cylinder. A curved built-in exhaust duct allowed the fitting of the special Taipan muffler designed for the engine.

Rossi R40-FI

The Italian Rossi R40-FI is a most appropriate product with which to end this brief history of .40 cu in. two-stroke-cycle engines. The Rossi motors have always been acknowledged as being among the leading examples of model two-cycle engine design and the R40-FI, introduced in 1986, may justifiably claim to represent the highest levels to which the .40 cu in. class front rotary-valve radio-controlled engine has been brought, to date.

The Rossi catalog calls this a "sport" engine—which is a bit of a misnomer, since, in the same catalog, the engine is rated at a most "unsport" power output—no less than 1.95 bhp at 17,000 rpm! Even allowing for a little exaggeration in the factory's performance claim, one hesitates to echo Rossi's inference that the engine is suitable for "fun" flying by (apparently) "first timers"...We think the R40-FI is far too good to be wasted in this way... It is also a bit on the heavy side (15.1 oz bare; 17.5 oz with muffler supplied) for some R/C trainer and sport models.

Externally, the Rossi R40-FI looks like a thoroughbred. Internally, it has all the hallmarks of a durable and very powerful motor. The crankshaft main journal, at 17 mm diameter, is the largest yet on a shaft-valve 40 and provides a massive valve port. A most impressive piece of work.

2012 A.D.?

And so we conclude this survey of a quarter-century of "40" engines. Anyone care to forecast what the next twenty-five years will bring?

Peter Chinn, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. ■

EASY

(Continued from page 35)

assembling the fuselage by gluing the two cabin formers in place on one of the sides. Make sure they're perpendicular to the side by checking with a right triangle. When dry, glue the other fuselage side to the formers, making sure it is in perfect alignment with the first. Bring the tail together and glue; when dry, mount the firewall. It's a good idea to use epoxy to hold the firewall in place.

Sheet the bottom of the fuselage from the back of the wing saddle to the tail with 1/16-inch balsa with the grain running across the fuselage. At the very tail the balsa is replaced with 1/16-inch plywood for the tail-wheel mount. Build up and glue the landing-gear mount in place just in front of the first cabin former. Install the nyrod guides from the cabin area to the tail. Drill the nyrod supports and trim them to fit between the fuselage sides, then slip them over the nyrods and epoxy them in place.

Epoxy the 1/8-inch copper tube and overflow lines as well as the throttle line through the firewall and install the floor in the tank compartment. Wedge the tank in place with foam and connect it to the copper tubes with fuel tubing. Watch for and eliminate any kinks in these lines. Finish the cross grain sheeting and sand the completed fuselage.

If the wing is to be attached to the fuselage with nylon bolts, position the hardwood blocks at the fuselage sides and glue. Temporarily mount the wing in

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EASY

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the saddle with rubber bands. Be sure it is correctly aligned; then use a 7/32-inch drill bit to drill through the main spar, between the dihedral braces, and into the hardwood blocks. Tap the holes in the blocks with a ¼ by 20 tap and enlarge the holes in the spars to ¼ inch to receive the wing bolts.

The original was covered with MonoKote*, which is recommended. A good alternative, though, would be Micafilm, a very light and strong covering that can be obtained at your local hobby shop. Whatever you choose, do be sure to follow the manufacturer's instructions for application. The rudder and elevator hinges on the original were MonoKote; but hinge the surfaces in the way you're most comfortable.

Trim the covering away from the center of the stab and epoxy it into the slot provided. Epoxy the fin and rudder to the fuselage in the same way. Trim the covering away and epoxy the ¼-inch wing mounting-dowels in place if they're used.

Bend the tail-wheel axle and mount it with the tail-wheel bracket. Cut out the ⅛-inch plywood tail-wheel bracket pad, epoxy it in the location shown and mount the bracket with epoxy and small wood screws. Bend the U-shape tiller holder and slip a piece of fuel tube over the tiller before capturing it in the holder and attaching it to the rudder. The fairings on the landing gear are cut from ⅛-inch balsa, sanded to shape and glued to the legs.

Before bolting the engine mount to the surface, it's a good idea to paint the firewall with a coat of epoxy. When the engine is mounted, attach the fuel line to the carb and the overflow line to the muffler if pressure is desired. Run a piece of soft iron wire through the throttle nyrod and connect it to the throttle arm. A U-shape bend in the wire at the arm acts as an adjustment as well as a strain relief for the servo. Bend up the landing gear legs, add the wheels and hold them in place on the gear mount with metal brackets and small wood screws.

Before installing the radio, assemble the airplane and check the balance point. Move the battery pack and servos around until it balances at the point indicated on the plans, then install the radio to maintain this balance. Connect the elevator and rudder to the servos with nyrods, clevises and horns. Make a Z-bend in the throttle wire to engage that servo. Check to see that everything responds properly to the transmitter controls and, after a range check, the airplane is ready to fly.

FLYING. If this is your very first four-stroke, forget what your ears tell you and hoist EASY off just as you would any of your sport airplanes. The power is more than enough although it sounds as if it's only running at half throttle; low and slow while upside down or fast and loose way up there in the blue. Stalls, both inside and outside, are gentle and forgiving—so you can apply a little power. It will snap, but you'll need full elevator and rudder to do it.

Impress your friends by rolling into a 360° overhead approach and slipping all the way to a landing. But don't just let them fly your airplane—or they'll see how EASY it was!

**The following is the address of the company mentioned in this article:*

MonoKote: from Top Flite Models Inc., 2635 S. Wabash Ave., Chicago, IL 60616. ■

CARE OF .40s

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The best way to prevent this is simple. Run your engine dry by pinching off the fuel line at the close of your flying day. Then add a few drops of lightweight oil or Pacer* After-Run into the engine intake and flip the prop a few times. Also, be sure to completely drain your fuel tank after the day's flying. If you don't, moisture will form inside of it due to the evaporation process of the remaining fuel.

Foreign debris can also spell a short life for your engine. This can be anything—dirt, grass, sand, or even bugs. I say bugs because one cost me a Pylon race a few years ago. It somehow got trapped inside the spraybar in my carburetor and gave the engine fits. I have never respected mosquitos since. What can I say about dirt, grass, or sand. Your carburetor is like a vacuum cleaner; and believe me, it will suck up anything in its path. You may not even see that grain of sand or bit of asphalt, but your engine will sure suffer from it if it digests it. A filter on your pick-up line and another over the carburetor are inexpensive insurance when compared with the consequences of not using them.

The other enemy to our engine is heat. Obviously, we need some heat to operate the engine. The normal combustion process as well as the movement of the internal parts both generate heat. Friction is the result of one metal part rubbing against another. To subdue the amount of heat generated by this friction we use lubricants. But with a new engine, particularly, the internal parts are usually tighter fitting, thereby leaving less room for the lubricant to do its job. With less lubricant, you get more friction and thus more heat. As the heat increases, the metal parts swell. If the clearance for this swelling is not sufficient, the metal parts will lock together and *seize-up* the engine. This is bad news because as this occurs, a severe amount of wear takes place on those parts. If this happens, chances are your engine is in for a short lifespan.

To prevent your engine from locking up on you, it should be broken-in before running it at full power for any duration. What is the best way to break-in a new engine? Good question, and one that has as many answers as there are modelers! Seems like everyone has their own method, and if it works, great. My advice

DUKE'S MIXTURE

I have the Taiwan flu, and my friends, it's as rough as some of the motors that they produce.

There are a lot of shows around the country these days, but IMS, in Pasadena, has a special flavor all its own. Besides the usual commercial booths and displays, there is a lot of indoor flying. There was space in the center of the hall for that purpose, and there were quite a number of show sponsored flights, and a lot of flights of people that just went out and sent their model up. I probably saw 50 kids with their wind up rubber models of various descriptions. There was one ornithopter of unique design that managed to reach the rafters some 30 feet up. Also, some electric control line and electric R/C flying. You West Coasters who didn't go to that show really missed something worthwhile.

To my interested friends, I have to report that our experiments with a fan motor have been set aside until we can get a more sturdy crankcase. It seems that the loads imposed by an even slightly out of balance fan are a great deal larger than I visualized, and more than our case can stand. I guess that is one more project that is going to take a lot longer than I anticipated.

I have always been a creative designer — more interested in solving a problem than milking the solution. Many of my firsts have been ill fated, but a few, like the one piece case and cylinder design with slip liner, and the use of platinum rhodium glow plug alloy, have become industry standards — and I received no benefit. Now, at age 67, I have decided that my future innovations will receive patent protection wherever practical.

My patents on case design and the new .018 motor have been granted. My new porting system for racing motors has been approved, and all claims on my control system for R.C. ornithopters have been allowed.

Now that the concepts are protected, the hard work starts — that of developing these concepts into something that somebody would pay money for. That should keep me busy for quite a while.

Simple solid wing control line models like Guillow Trainer and Top Flite Streak Trainer have become unobtainable. That distresses me because what do you sell a 10 year old who wants to get into model airplanes? If there are any kit manufacturers out there who would like to sell another 25,000 kits a year, contact me. I will design it for you.

The courts have recently held that accountants who fail to report an audit accurately can be sued under malpractice laws by any person who is harmed as a result of that report. While this was intended to protect corporate investors against rigged stockholders' reports, it appears to me that if you or I are audited by an IRS agent, and he passes over items in our favor and concentrates only on what we owe the government, we can sue him individually for damages. It will be interesting to see what the legal beagles do with this concept.

The February issue of Discover has a remarkable article on R.P.V.'s. You will find it fascinating.

Happy flying.

Duke Fox

FOX MFG. CO. — 5305 TOWSON AVENUE
FORT SMITH, ARKANSAS 72901
PHONE (501) 646-1656

CARE OF .40s

has always been to run the engine first on a test stand. The reason is simple. It is very difficult to monitor the heat of an engine when it is buried in an airplane flying at 70 mph! On a test stand you can do this quite easily.

If you have a test stand, fine. If you don't, you can use your airplane. Just make sure that you have someone to hold it and never make any adjustments to it from the front. When I run-in a new engine, I set the needle about 4 turns out, attach the glowplug battery, and start the engine. When it's running, I remove the battery. If the engine dies, I turn the needle in a little and try again until it will run without the battery attached. By the way, it is a good idea to have the throttle opened all the way on break-in. With the engine running, I slowly turn the needle in until it reaches a point between blubbering rich and just rich. I let it run at that setting for a few minutes and then shut it down by *closing the throttle.* The reason for this is that you don't want the engine to overspeed, as pinching off the fuel line will do.

Immediately following the first run, I tighten all the screws on the engine. At the same time I check the bottom of the crankcase for any abnormal heat. You should be able to put your finger on it without getting burned. If you do you have a problem, maybe either the crankshaft is too tight or the bearings are misaligned. It should be warm but not *hot hot.*

Repeat this procedure several times without changing the setting on your needle. Gradually increase the duration of each run until you can put an entire tank of fuel through it without the engine changing speed or getting abnormally hot. This is a compromise in most cases since you need *some* heat to let the parts wear-in properly, yet you don't want too much as it could cause the engine to seize.

When the engine will hold a rich setting, turn the needle in until it is between rich and lean. You will be able to tell this from the sound—it will peak, then break off, peak and break off. Let it run at this setting for a half tank and shut it down, again by closing the throttle. Let the engine cool and do it again. This is the most critical point in your break-in procedure. I generally run several tanks through the engine like this, then go to the final procedure.

With the engine running at the same setting as above, I carefully and momentarily pinch off the fuel feed line to the engine. It will speed up to peak rpm and then drop off as I release the pressure on the line. I do this a dozen or more times, at 15-second intervals, and shut the engine down to let it cool. I then repeat the process. Do make sure you're wearing ear plugs or you might end up with impaired hearing.

After I have gone through all of the above procedures, I put the engine in my airplane and complete the break-in while flying the model. I do this because these are air-cooled engines and there's no way you can properly cool an engine while running it on a test stand. Nor is there any way to match the conditions of flight on a test stand, in particular rpm. Simply stated, your engine will turn up higher revs in the air since it can "unload" while flying. This is something you should keep in mind. You can run your engine on the test stand forever yet never really break it in thoroughly, not until it is flown. It may still take many flights before it finally starts to come "in," and for that reason

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CARE OF .40s

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you should take care that your needle setting is slightly off the peak when you set it on the ground prior to flight. One reason for this is that your airplane is no longer a stable mount for the fuel, and its position is constantly changing, thereby affecting the flow to the carburetor. Another factor is gravity and the force it exerts on the fuel in changes of attitude. As far as gravity goes, fuel is still a solid mass having weight, and that weight is multiplied by the G-forces applied to it.

Once your engine is broken-in, don't forget to tighten all of the screws and keep it clean and well lubricated, especially for storage during the winter. If you do these things, that little gem will be ready, willing, and able to perform for you every time you need it.

**The following is the name of the company mentioned in this article:*

Pacer Technology and Resources, 1600 Dell Ave., Campbell, CA 95008. ■

CHINOOK

(Continued from page 69)

probably have most of these fittings and a set of wheels on hand to fit this particular model, yet the fittings kit with aileron bellcranks and wing strut fittings, and the pilot undoubtedly were a worthwhile purchase.

At this point it should be mentioned: this is not a kit for the beginner even though it is a conventional construction. As a step-by-step construction format is presumed unnecessary for the more experienced modeler, instead I'll review some of the highlights of the assembly with a few suggestions.

CONSTRUCTION. As with any model airplane kit, the first step is to thoroughly read the building instructions comparing these to the assembly photographs, the plans, and all of the kit parts. Be aware that the building instructions aren't entirely in the exact order of assembly, undoubtedly due to the translation to English. It will be necessary to read and study the instructions several paragraphs ahead of the assembly order in order to prevent joining parts together out of sequence.

Select the radio gear you wish to use *before* beginning construction, as parts of the gear are used in the initial assembly. Your choice of engine should also be selected before beginning construction so the proper linkage can be installed during initial assembly. My choice was a well-used .40 four-stroke setup for standard rotation and using an 11x7 pusher propeller. Any reliable .40 to .48 four-stroke engine will power the airplane very realistically. Just remember, this is a pusher type airplane so it will require a pusher propeller, or conversion of the engine for reverse rotation if you plan to use a standard propeller.

All of the parts in the kit are metric sizes so frequently the building instructions will reference these parts by their metric measurements. If you don't have access to a metric scale, simply divide the millimeter dimension by 24.5 to obtain the fractional inch equivalent.

Because the fuselage is assembled after the landing gear is installed, the gear should be epoxied in place in addition to the use of the mounting straps to prevent sideways movement of the gear. Don't cement the instrument console in place during assembly. Install this assembly as one of the last steps. You may wish to paint this part flat black; and installing it last saves a lot of masking. The console will also make a great place to disguise some needed ballast.

When installing the fuel tank, again remember this is a pusher type airplane. Don't install the tank in the conventional manner as the rear of the tank must be installed toward the firewall. Because the tank is completely enclosed, with little access to the fuel lines, the use of any one of the exterior-mounted patented fuelers works quite well.

When cementing the wing rod connecting sleeves in position, you may find that they protrude slightly past the fuselage root ribs. This would prevent a snug fit between the wing root ribs and the fuselage. It may be necessary to add to the built-up thickness of the fuselage root ribs to prevent any unsightly gaps between the wings and the fuselage when assembling the model.

The tail surfaces are rather large for this size model and are built-up construction using large wood pieces. It would be wise to lighten the tail surfaces wherever possible, and perhaps to drill lightening holes in the elevator and rudder. Cover the tail surfaces before assembling these together and to the tail boom.

The wing construction requires no special instructions; but you may want to add lightening holes wherever possible. Take a great deal of care when cementing the brass tubes in place. These brass tubes carry the wing rods and if they're not aligned correctly in the root ribs you'll have a problem with the dihedral angle

and the proper sweepback of the wings in final assembly. Some adjustment of the wing root ribs may be necessary when you're using an engine with a muffler or a pressure adapter in the case of a four-cycle engine. The two-piece wings are mounted so close together at the engine location that there may be insufficient clearance for these accessories.

I suggest the use of a blind nut, buried in the fuselage, to hold a machine screw for attaching the wing struts to the fuselage. The use of a wood screw, as the instructions suggest, isn't very practical considering the frequency with which the model will be disassembled and reassembled.

The plastic parts, which include the clear plastic canopy, all require trimming to their exact size for a proper fit. The parts are thick and difficult to trim to shape with a knife. A Dremel Moto-Tool with a sanding drum works quite well for this operation, as does the cut-and-try method.

The obechi wood used in the fuselage has a large and deep grain so it must be filled before painting. Because the fuselage requires painting and the flying surfaces require some sort of covering material, I chose Coverite's* Black Baron line of film and their matching epoxy paint. My choice was Fire Red and on the completed model it is very difficult to discern where the film ends and the paint begins; they're perfectly matched. The Black Baron line of film requires no preparation to the wood before use. The fuselage was given two coats of "Black Baron" epoxy primer before spraying on the color. This is undoubtedly the finest primer I've ever used on a model airplane—it covers extremely well and sands to a perfectly smooth finish.

The pilot comes unfinished and requires some assembly and painting. The use of water-based acrylic artist colors has worked quite well to date as the pilot is completely enclosed and not directly exposed to any fuel or oils.

FLYING. The completed airplane weighed in at 7 pounds, 2 ounces, which included 3 ounces lead shot mounted in the nose for balance. This is about 5 ounces over that suggested in the kit specifications.

Try to obtain as much aileron throw as possible. This is very difficult to do considering the mini-servo that must be used to drive the ailerons. An alternative would be to use a radio that would enable you to couple the ailerons and the rudder for more effective turns. At this point it's worth mentioning that a better arrangement would be to install a mini-servo in each wing panel, thus driving each aileron directly. With the plug-in wings, connecting the aileron servos to the radio receiver would be a simple operation with a Y-lead coming from the receiver. There are special Y-leads on the market that prevent glitches from long servo leads.

For smooth operation use no more than 3/8 inch throw on the elevator; also, limit the rudder throw to no more than 5/8 inch. Remember, the rudder is directly in the airstream of the propeller blast so it becomes far more effective than on a conventional type model aircraft.

Even though the model isn't equipped with a steerable tail wheel, the airplane tracks very well on takeoff (the landing gear has 15 inches of track width and about 1.5° toe-in on the wheels). The Chinook flies very scale-like and is capable of mild acrobatics. Admittedly, with a .40 four-cycle, power is marginal, so most of your flying will be limited to calm weather. With a four-cycle engine

in the .45 to .48 range the performance would improve immeasurably.

With the engine completely out in the open, starting and adjusting the engine is a breeze. The Chinook is a sturdy model, one that should give the builder many hours of enjoyment. And it's an eye-grabber at the flying field.

**The following are the addresses of the companies mentioned in this article:*

Hobby Lobby International, 5614 Franklin Pike Circle, Brentwood, TN 37027.

Coverite, 420 Babylon Rd., Horsham, PA 19044. ■

GRANT

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figure was doubled, and after eleven years of his leadership, it had three hundred thousand readers!

During those years, Grant wrote and published over 300 articles on the design of model aircraft. His book *Model Airplane Design and Theory of Flight* became then, and still is today, the standard text on this subject.

When the Brown Jr. model airplane gas engine first appeared, there were no inherently stable miniature aircraft designs available. The famous "KG" was then designed by Grant and the prototype was constructed by Joseph Kovel; hence the name "Kovel-Grant." It was the first gas model which was stable on all three axes of flight. Plans of the KG were printed in *Model Airplane News* and in many other publications. "KG" airplanes were subsequently built in almost every country worldwide. Walter Good, the pioneer radio control flier, adapted the KG design to carry his Nationals-winning electronic control apparatus.

In 1933, Grant also founded the International Gas Model Airplane Association (IGMAA). Its many clubs and six thousand members subsequently became the nucleus of the present-day Academy of Model Aeronautics. For all these efforts, Grant has quite rightly been called the father of model aeronautics in America.

His many contributions to full-scale aircraft design were certainly no less important. His constant preoccupation with improving flight safety was a good indication of this altruistic thinking. Most of his inventions were basically aerodynamic contrivances directed at the goal of achieving safer operation of all aircraft. His variable-camber wing designs, and his multiple-segment wing flaps are typical examples of improvements which Mr. Grant pioneered.

Of all his eighteen U.S. Patents, the most important was probably the multiple section controllable wing flap system, U.S. Patent No. 2,146,014. It is found today on most of the world's transport and other high-speed fixed-wing aircraft.

Without this system, landing speeds of present-day turbine-powered airplanes would be impossibly high.

While the international aircraft industry freely adopted this and other of his inventions; with the exception of the Martin Company, none has ever paid him any compensation for the use of his patents. The Martin 202 and 404 airliners were among the first to use his wing flap design. After agreeing on a royalty payment, in a somewhat philosophical mood, Glenn L. Martin told Grant that it did not really pay for the individual inventor to work on new commercial ideas in the aircraft industry. Since WW 1, the Aircraft Manufacturers Association had reciprocal agreements whereby they all share in new developments.

In essence, this meant that an inventor like Grant would be required to institute

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GRANT

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and prosecute law suits against all the giant corporations who infringed on his patents—a monumental task!

One of the deficiencies of the United States patent system is that a U.S. patent is only as good as the inventor's ability to fight infringers in courts of law. This usually means either you have or have not the financial resources to protect your legal rights. Such law suits can and have lasted for an extended period of years.

This was Grant's major problem. Whatever royalties he received from the Martin Company, plus his other very limited capital resources, were all expended trying to protect his patent rights. In the end, he was unable to carry on the legal battles until victory could have been assured.

In spite of these frustrations and bitter disappointments, Charles Grant never lost his genial good nature. Even in the later years of his life, he remained philosophically in good humor. While in his eighties, he authored what was to become his last published work, *Gateway to Aero Science.*

Ever the optimist, Charles Hampson Grant still tried to install the youth of America with his vision of the virtues of pursuing lofty goals in the skies. In his own words: "Perhaps some future adventurous astronaut will be able to travel through space to distant worlds, because he passed through this gateway to aero science." ■

SCRATCH-BUILD

(Continued from page 29)

vibration, so it's a good idea to wrap the battery pack in foam rubber. Since the battery is close to the fuel tank, you should wrap it with the foam rubber inside a plastic bag just in case of a fuel leak. When you place the battery in your airplane it should also be secured since you don't want it moving around during flight. If it does, it could interfere with servo action, or worse, become disconnected. If this happens in the air your chances of saving the airplane are not very promising. A snug fit of the battery is all you want, but if your fuselage is big, you may have to mount it inside a box that is secured to the airframe or put balsa rails on top of it to keep it from moving around.

The next part of your installation is mounting the switch. No problem you say? Well believe it or not the airborne switch on a model has caused more crashes that we'll ever know. Why? Vibration. That's right, it can tear that switch apart in short order. The contacts inside the switch must move from one position to another in order to function. Because of this they don't have a permanent home and cannot be secured. These contacts are metal and you know what happens when you rub metal to metal without any lubrication—things wear out real fast. Beside the vibration problem we must contend with in the switch, we also have deposits from fuel, dust, and electrolysis.

For this reason it's a good idea to mount the switch inside the airplane and use a commercial switch mount that allows external access via a pull-on/push-off command. The location of the switch is normally between the battery and the receiver.

The next part of the radio installation is the receiver. This is the heart of the system and should be treated accordingly. It is very delicate and needs special attention. Since it is usually the lightest component in the airborne baggage we can place it anywhere in the airplane we wish without bothering the balance point. Unfortunately, the wires that attach to the receiver are usually not long enough to allow us to do this, so we use the distance of these wires as a sort of a guide. Never use excessive servo extension leads to attach a servo to a receiver in a normal radio installation. If you do so, you should add noise traps and a larger battery.

Since we have in the receiver the most delicate part of our entire airborne system, the crystal, we must be very careful with it. Here again engine vibration can drive a receiver crazy, so make sure it is wrapped in foam rubber and snugly positioned in the fuselage, yet secured enough so it does not move about. It's also good practice to place the receiver in a plastic bag and seal it with scotch tape to keep dust and fuel residue out.

The final part of the radio installation is the receiver antenna. Again we have a compromise. The position of the antenna is very important. For it to be the most effective in receiving the signal from the transmitter it should ideally be at 90° to the transmitter. Obviously this is not possible since the airplane is constantly changing position and attitude. So what do we do? Fortunately our receivers are sensitive enough to pick up small or diminished signals due to these changing attitude conditions. I usually place at least the last 6 inches of the antenna at 90° to the front part to make sure that I pick up the transmitter signal during any kind of situation or attitude. It's just a bit of added insurance.

The antenna should also have enough tension on it so that it doesn't flop around and possibly get caught in the propeller. An easy way to do this is to attach a small rubber band to the vertical fin and then stretch it forward and tie the receiver antenna to it. Better yet, use the small plastic clip that comes with your radio. *Never shorten or lengthen the antenna.* The antenna is tuned to the receiver the way it comes from the factory and changing its length could really mess you up.

Every radio set comes with an assortment of servo outputs. Some are round and some are straight and are called "arms." When you place these on the servo, make sure you have the output at 90° to the horizontal centerline of the airplane and that they are secured with the screw provided. When you attach the pushrod to the output, make sure you run the servo in both directions with the transmitter and that there is no binding. It's not a good idea to use a clevise on a rotary output. If you use a rotary output, use either a Z-bend in the pushrod wire or an EZ link.

For more information, refer to my article "Basic Control Systems" in the September 1986 issue of *M.A.N.* If you don't have that issue, a copy of the article is available from *M.A.N.* for $2.00. For more advanced systems write to *M.A.N.* for Jim Newman's book *Control Systems* for $4.95 plus $1.50 postage and handling. It contains some good information with illustrated samples of hookups

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SCRATCH-BUILD

(Continued from page 121)

for things such as articulated flaps, folding wings, etc.

Take your time during this critical period of your model's assembly and you will have a lot of fun enjoying all this hobby has to offer. Good luck.

Dan Santich, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. ■

HELICOPTERS

(Continued from page 37)

fan and clutch as there could be a problem here also.

We're trying to eliminate potential sources of vibration by going to these extra steps. In fact, I don't consider these steps to be extra at all, since they have all become part of my assembly process. Vibration can be a problem in the average model because of the damage it can do to parts and radio equipment. Every effort to eliminate vibration will pay off with a smoother and easier-to-manage helicopter that will require less repair time and maintenance of worn parts. Besides, a shaky machine just doesn't look good in the air.

Once you have the power unit assembled, it must be attached to the main frame assembly. Once again, you'll need to temporarily attach the fasteners (leave them loose) so that the unit can be aligned with the drive gear later. If you need to remove the needle valves from the engine, be sure to keep track of the number of turns out from the full-in so you can get an estimate of the needle setting when you replace them. If your machine uses a

starting belt, don't forget it. If you forget, you'll have to pull the whole assembly to replace it.

Now we can begin with the assembly of the main drive gear and shaft along with the swash plate, and collective pitch control (on some models). This is an area where we will begin to see a great deal of difference from one machine to the next, and I recommend that you read the instruction manual and study any drawings and photos that are available to you. This is one area where things can get put together backwards, so be sure you have a good idea of how things fit before you find you have to take anything apart to re-assemble it properly.

If your machine uses a sliding rod and rings to control the collective pitch, you must take time to be sure all of the parts move freely. The pitch control rod slides inside a groove in the main shaft. Often the rod will not be bent absolutely straight and when all of the parts are assembled on the shaft the rod will bind. I use a piece of 320-grit, or finer, sandpaper face-up on a plate of glass to rub the back of the rod on. If you hold the rod by the two bent ends and rub the rod against the sandpaper until the entire back side of the rod is shiny from the paper, the rod will be perfectly true.

Another potential source of trouble is the slide ring and follower which attach to each end of the rod. Often the holes are machined to accept the pitch control rod and are not drilled perfectly perpendicular to the main shaft. If this situation exists, it will be necessary to re-drill the hole.

Once you have fine-tuned the pitch control rod and rings, assemble all of the parts on the main shaft (follower, collars, swashplate, mixer, etc.) in the correct order and check the movement of the parts up and down the shaft. All the parts should fall freely from their own weight before the fit is acceptable. This last step is true for any type of helicopter so be sure that you get this part right. The result of a sticky or tight fit of parts on the main shaft is a helicopter that will not be controllable. The collective pitch will hang up and the helicopter will either climb or fall unpredictably. When the collective pitch system is working properly, very fine pitch inputs are possible and the helicopter is much more stable.

Once you have installed the main drive gear and all of the components with it, you'll be ready to set the backlash between the main drive gear and clutch pinion gear. The first step is to be sure that you have taken all of the end play out of the main shaft assembly. Rotate the main shaft to be sure that there is no bind in the bearings and tighten the screws for the main shaft bearing blocks only. Now pull up on the main shaft, and hold it while you tighten the follower or plate lock so that the shaft cannot move up or down at all. Re-check the shaft end play from time to time to be sure that it hasn't slipped. Next, tear a piece of notebook paper or other type of bond paper to about three inches long and ½ inch wide. Insert the paper between the main drive gear and the clutch pinion by rotating the drive gear. While the paper is between the gears, press the clutch pinion against the main gear and hold while tightening the pinion bearing blocks. Now rotate the gears to remove the paper and the backlash will now be approximately .003 to .004 inches. This method is very quick and simple yet accurate. Never grease the

(Continued on page 128)

NAME THE PLANE CONTEST

Can you identify this aircraft?

If so, send your answer to Model Airplane News, Name the Plane Contest (state issue in which plane appeared), 632 Danbury Rd., Wilton, CT 06897.

The winner will be drawn four weeks following publication from correct answers received by postcard delivered by U.S. Mail and will receive a free one-year subscription to Model Airplane News. If already a subscriber, the winner will receive a free one-year extension of his subscription.

Intended for production in 1947, the Aeronca Chum had a top speed of 115 mph and was touted as being spin-proof. This two-place "personal plane" had a 49-mph landing speed and cruised at 105 mph with 60 pounds of baggage. Its 22-gallon wing tanks gave this simplified-control, tricycle-landing gear, metal-fuselage plane a range of 400 miles. It was powered by an 85-horsepower engine. Congratulations to J.B. Sullivan of Honosassa, FL, for correctly identifying March's mystery aircraft. Other correct entries were Stephan Jeziorski, Edward F. O'Donnell and others.

HELICOPTERS

(Continued from page 124)

plastic main drive gear. Any particle of dirt that is picked up by the grease becomes imbedded in the plastic and will eventually wear out the steel pinion gear.

Once the main drive gear mesh is set it is time to align the engine and clutch. Before tightening the engine mounting bolts, be sure that the clutch is perfectly centered inside the clutch bell. Also be sure to back the engine and clutch out of the bell slightly so that there is clearance for any end play in the crankshaft. The trick here is to slide the engine all the way into the bell until they contact each other, and then just pull the assembly back out approximately 1/16 inch. Study the rotation of the bell around the clutch to be sure that the alignment is correct. Work with this until it is right, and you will avoid another potential source of vibration and excess wear.

This should give you something to work on until next month when, hopefully, you'll be ready for the final assembly, radio installation, and hook-up of the control linkages.

Manufacturers Spotlight

This month concludes our coverage of Yale Hobby Manufacturing with a look at some of the aftermarket accessories available through them.

In addition to the Tru-Spin line of rotor blades, Yale Hobby Manufacturing now offers a line of accessories that include many unique items for the helicopter enthusiast. Among these items are a low-cost set of quilted blade covers available as a set for both the main rotor blades, and the tail rotor blades. The covers will reduce the chance of the blades becoming damaged during storage and shipment.

Along with this, there is now a complete training gear system available which helps to keep the helicopter from tipping over while you learn to hover. The training gear comes in two sizes (one for .20 size helis, and the other for .40 to .60 machines); all of the needed hardware is included along with assembly instructions. One of the unique features of this item is that it is designed to be broken down for transportation and storage. If you're just getting started you'll need some sort of training gear for your first outings. The small purchase price of the gear will save many dollars and hours of replacing other parts of the helicopter.

Yale has also come out with two types of replacement canopies for most popular brands of kits—fiberglass canopies, and crystal clear vacuum-formed canopies. The advantage of the fiberglass canopy is its extra durability. Canopies included with most kits will fatigue from vibration stress after a short period of time; but fiberglass will hold up indefinitely. The crystal clear vacuum-formed canopies offer superior strength over the original units and are formed from the clearest material I have seen to date. The bodies are protected from scratches during shipment by careful packaging so that you at least have a chance to put a body on your machine that isn't marred right out of the box.

The last item on the list is the new precision-ground steel mainshafts. Because they're of tougher material than the stock shafts, Yale shafts can endure more punishment. I've gone through many mainshafts and hoped for a stronger part while learning to fly. It seemed that I could bend a shaft without even breaking the rotor blades. At any rate, the replacement main shafts are actually priced lower than the original parts, so you can't lose.

Club of the Month

THUNDERVOLTS

The Thundervolts Radio Control Club of Schenectady, New York, is the *Model Airplane News* "Club of the Month" for May 1987. Club President Rod Priddle says "the club seems to be on an all-time high," except for their need to acquire a permanent flying field. Several temporary locations have not worked out.

A recent mall show was a huge success and 43 new members have signed up for the club's "Getting Started in R/C" classes. A Memorial Day Weekend pattern contest is planned. Upcoming programs include a troubleshooting forum and a talk/slide show by Air National Guard Master Sergeant David Getty on the ANG's roll in Greenland. A Show & Tell segment brings to the club innovative ideas and the sharing of building projects and modifications.

Model Airplane News applauds the Thundervolts and is pleased to award to them two free one-year subscriptions, which are to be given by them to their outstanding junior members.

Congratulations!

Each month Model Airplane News will select the club newsletter that best shows the club's activities and energies directed toward the furtherance of the hobby. The award is not based on size or quality of the newsletter, and can be about any aspect of the hobby (F/F, C/L, R/C, boating, cars, etc.). Model Airplane News will award two free one-year subscriptions to be given by the club to outstanding junior members. So send your newsletter to Model Airplane News, Club of the Month Contest, 632 Danbury Rd., Wilton, CT 06897.

HELICOPTERS

That sums it up for Yale Hobby Manufacturing, and next month I'll pick another manufacturer for review.

Pro Tip of the Month

When setting up the tail rotor linkage on helicopters that use the JR Century VII, PCM 9, Apollo VII, or Galaxy, follow this procedure before you make the tail rotor pitch control linkages: turn the ATS system switch On, adjust the mix knobs to the center positions, put the rudder trim lever in the center position. Now, turn the ATS system switch Off. This will enable you to get the maximum range from your anti-torque mixing system. This is often a problem when you're using lots of tail rotor throw and need the compensation especially for descents into autorotation. It seems that often you can run out of range on the system if you don't set it up properly from the beginning.

That's it for now; keep the spinning side up!

The following is the address of the manufacturer highlighted in this article:

Yale Hobby Manufacturing, 20 Holly Lane, Wallingford, CT 06492. ■

PATTERN

(Continued from page 78)

many of us rather than the few who jeopardize them.

Secondly, the rule insures that the aircraft is ready when it arrives to fly. I admit a lot of action takes place on the flight line even though it's not supposed to; things like changing plugs, props, remounting the spinner, and who knows what. But adjusting the noise level just doesn't happen at the line. Believe me, it takes time and experimenting to get the noise levels down on any given model. Attempting to adjust to meet the passable noise level at the line is almost impossible.

Now for the sigh of relief in this matter. I said that this applies only to the FAI pilots, not the AMA pilots. I have yet to see any noise tests made at the flight line of a pattern meet except the Nationals and then enforced to the point of eliminating the ship from competition. So, until that point is reached, Paul and other pilots worried about the noise rules won't have to worry. I think the rules have merit and are reasonable. I also agree with Paul in that impounding is a bit excessive. I, too, value my expensive equipment and guard it closely. And I agree that we may experience a loss of pilots if we fail to make our opinions known on the matter. Paul has made his stand, as I have. Whatever you do, don't take things laying down. You have to live with it.

Winterizing

By the time this column hits your door, most of the country will be knee-deep in cold weather. For those of you who are restricted by the cold weather, remember to be safe when mothballing that flying equipment. Store all fuels and combustibles as far away from any heat source as possible. Always use plenty of ventilation when using products which emit fumes that are harmful. Always read the label of what you're using (all year round) and make sure that you're prepared for an emergency. Know the number of the fire and emergency services in your town. You may never need them, but if you do, you'll be ready to take fast and life-saving action. The life you save may be your own.

Mike Lee, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897. ■

GIANT STEPS

(Continued from page 81)

perhaps a trifle suspicious of a bargain, he sorted through a number of cells, discarding those in which he was not entirely confident. He subsequently had an in-flight failure and lost a good model. As it turned out, the "bargain" cells were the problem. They turned out to be something less than the bargain he had thought.

Considering that our batteries are the very heart of our radio systems, it seems foolish to take chances with them. It makes sense to use the best cells available and to replace them at regular intervals. With good quality cells, I'd be inclined to replace all cells approximately every four to five years. While it's true I might be throwing away cells which still had some life in them, I'd rather do that than risk the loss of an airplane. Those used cells could perhaps power a fuel pump, or a starting pack, or whatever you need. To fly with them is taking unnecessary chances.

Two years ago at Toledo, I made a point of buying some SR* batteries for replacement of some cells I felt were getting a little too old. It was a good decision. The SR cells have exceeded every claim made for them by the supplier. They last longer and their capacity is higher than claimed. In short, they are the best buy around today. If you need

batteries, you could do a whole lot worse than getting SR's superb quality batteries.

Heat-Shrink Wire/Wood Joints

If, like me, you build models which often require wooden fairings to be fastened to wire struts, you'll be as pleased as I was with the information I recently got from Dr. Nino Campana and the Soo Modelers of Sault Ste. Marie, Ontario.

If you've tried to glue wood and wire together, you've probably had them come apart at even a slight bump, never mind some of the "hard landings" we all occasionally experience. One solution is to use the heat-shrink tubing which is available in a wide variety of sizes from electronic supply houses. It comes in several colors, although a supplier might only have one color in stock. It's usually black although I'd bet it could be painted with any of the paints used to dress up plastic models. It's a good idea to check a sample to be sure the paint you intend to use is compatible, however.

Choose a tubing size which will slip easily over the wooden fairing and the wire cabane or landing gear strut. Apply heat and watch the tubing shrink to a tight fit over the wire and the wood. The heat-shrink material can react badly to a flame or the heat of a soldering iron, so a hot air gun is the best way to go. It's a neat and tidy method of making this difficult connection and having it stay in place. Cutting the tubing a little longer than necessary will cause it to shrink to the size required to cover the strut. Cutting it long and then trimming to the appropriate size after shrinking is probably the best way to go.

Thanks and a tip of the "Giant Steps" hat to the sharp people in Sault Ste. Marie for this good idea.

IMAA Festival '87

For those of you who've attended IMAA festivals in the past, the 1987 edition of this popular event will take place at Converse, Indiana, June 11 to 14. I haven't seen the Converse site myself, but am told it's a great place to fly—something over 50 acres of concrete, the remains of an abandoned USAF field. While I don't have a great deal of detail yet, I understand there are good accommodations in the immediate area and there will be plenty of room for self-contained RVs on the site. No RV services will be available as far as is known at the time of writing.

While the event is scheduled earlier than it has been in the past, the idea is to avoid the extreme temperature and humidity which prevail in the mid-west in July and August. As a person who is more used to a temperate climate, I'm looking forward to not being baked to death! The Converse group is working hard to assure a warm Indiana welcome to you all. They have staged a large rally there in years past, and their experience and the cooperation of IMAA Director and Festival Coordinator Dick Garmhausen should assure a well-run, well-attended Festival '87. I hope to see you all there. Join us, join IMAA, and come prepared to enjoy yourself and meet all the movers and shakers in the BIG airplane movement.

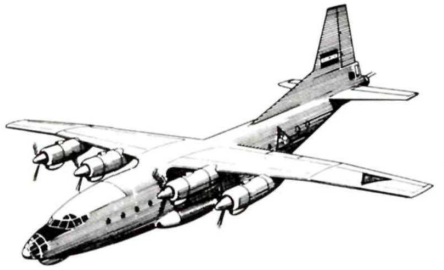
Dick Phillips, c/o *Model Airplane News*, 632 Danbury Rd., Wilton, CT 06897.

**The following are the addresses of the companies mentioned in this article:*

Ace R/C, Inc. Box 511C, Higginsville, MO 64037.

Ram, 4736 N. Milwaukee Ave., Chicago, IL 60630.

SR Batteries, Inc., Box 287, Bellport, NY 11713. ■



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WANTED: Model airplane engines and model race cars made before 1950. Jim Clem, 1201 E. 10, P.O. Box 524, Sand Springs, OK 74063; 918-245-3649.

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FOR SALE: *Flying Aces* 1935-1944, *Model Airplane News* 1931-1960, others. $1 for list. Bruce Thompson, 328 St. Germain Ave., Toronto, Ontario, Canada M5M 1W3.

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PRIVATE COLLECTION: Hundreds of aviation magazines for sale—*Popular Aviation, Flying, Model Airplane News, Air Trails, RAF Flying Review, Wings,* and many others. 1932-1960. All in excellent condition. Send $2 for list. William C. Fort Jr., 4161 Robin Hood Rd., Jacksonville, FL 32210.

SCALE DOCUMENTATION: PLAN ENLARGING. Photo packs, 3-views, drawings for 1,600 aircraft, super-scale R/C plans for Giant, Sport; 30-page catalog $3. Scale Plans and Photo Service, 3209 Madison Ave., Greensboro, NC 27403; 919-292-5239.

JETEX ITEMS AND KIT WANTED for cash. Kits by such makers as American Telasco, Berkeley, Comet, Cleveland, Monogram, Tailored, and others. Paul Williamson, 5032 S. Ridgeview, Nashville, TN 37220.

HARRY HIGLEY BOOKS: *There Are No Secrets*—on finishing model aircraft, including paints, adhesives, heat-shrink plastics, shaping, sanding, priming, etc. *Harry's Handbook for Miniature Engines*—from basic theory, components, and fuel to break-in, repair, and new developments. *Master Modeling*—explains drawing plans, how to scratch-build, use plastics, foam, fiberglass, balsa, and plywood. *Tom's Techniques*—from Tom Ingram, in collaboration with Higley, applying plastic film, covering wings, fuselages, Horner wing tip fillets, etc. Hundreds of photos. All books are $10.95 each, plus $1.50 postage each. *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897.

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WANTED: *Flying Aces, Model Airplane News, Air Trails,* 1920s-1950s. Bruce Thompson, 328 St. Germain Ave., Toronto, Ontario, Canada M5M 1W3.

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WANTED: Plans and specs Curtiss Falcon biplane two-place mid-'30s kit. Used military mail. Falcon, Box 125, Cumberland, ME 04021.

CANADIANS: We have R/C cars, planes, helicopters, engines, and related items at very competitive prices. For FREE price list, write: THE OUTLET, 5305 49th St., Yellowknife, N.W.T., Canada X1A 1R1.

MAGAZINE COLLECTION: *Model Airplane News, Flying Aces, Air Trails, Popular Aviation,* etc. 1932-1960. Comprehensive lists, individually priced with collector condition rating for $4. Dick Hill, 8826 John Dower Rd. S.W., Tacoma, WA 98499.

OHLSSON 60 model airplane engine bought in 1940. Excellent condition. Make offer. Richard Clement, 6 South 9th St., Marshalltown, IA 50158.

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HUGHES 500DE, JET RANGER heli fuselage, replace those unsightly holes of cutout windows with an Air Screen Kit, finish with a professional look, order now! Kits $5.45, $1.50 postage, information brochure $1.00, to Alvin Harris, P.O. Box 3462, 1018 E. 23rd Ave., Tampa, FL 33601.

Send ad and payment to *Model Airplane News,* 632 Danbury Rd., Wilton, CT 06897.

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Closing Date for either type of ad is the 15th of the third preceding month (for example, January 15th for the April issue). We do not furnish box numbers. If you would like your ad to run in more than one issue, multiply amount of payment by number of months that ad is to run.

It is not our policy to send sample copies or tear sheets.

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